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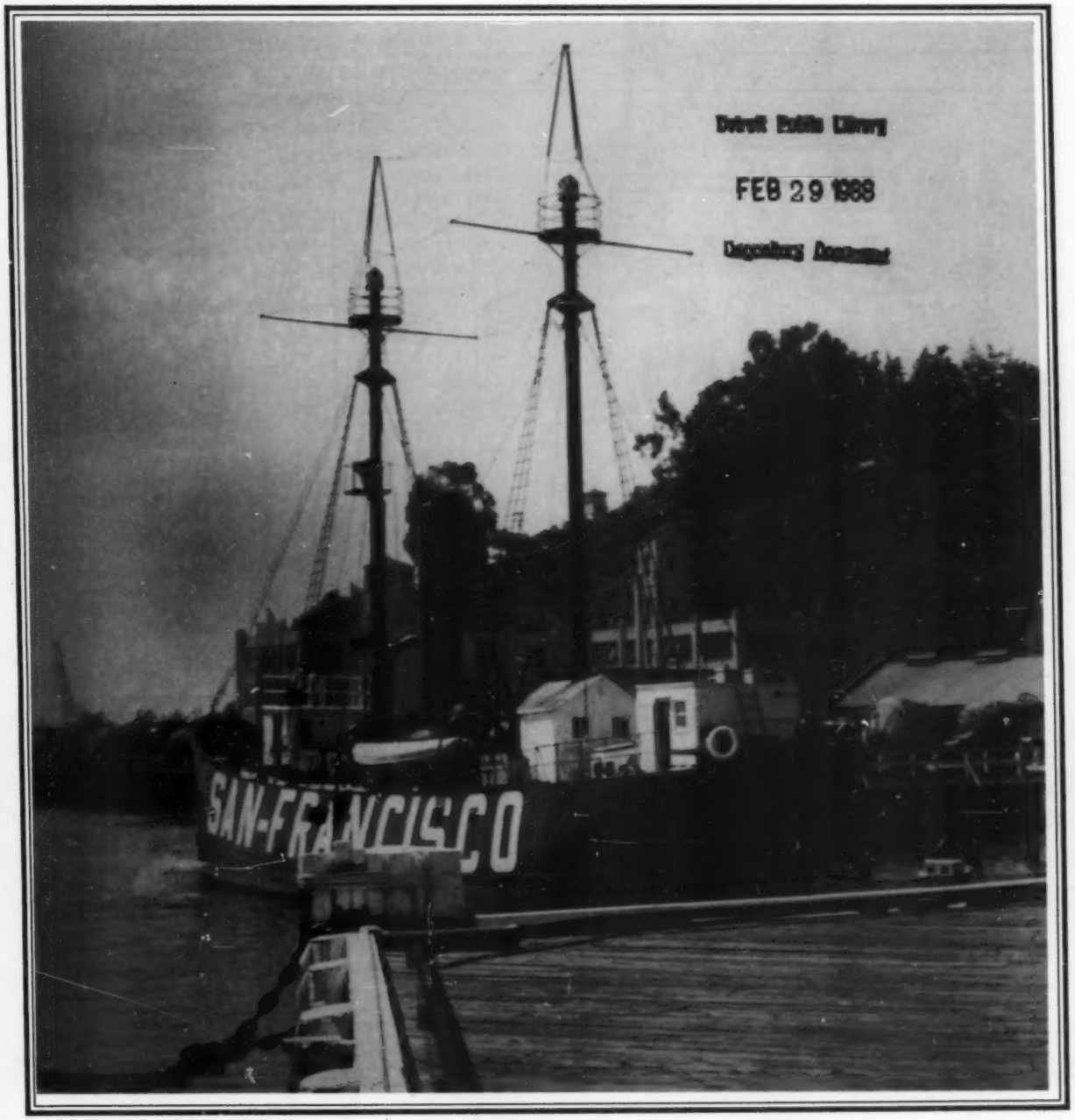
Mariners Weather Log



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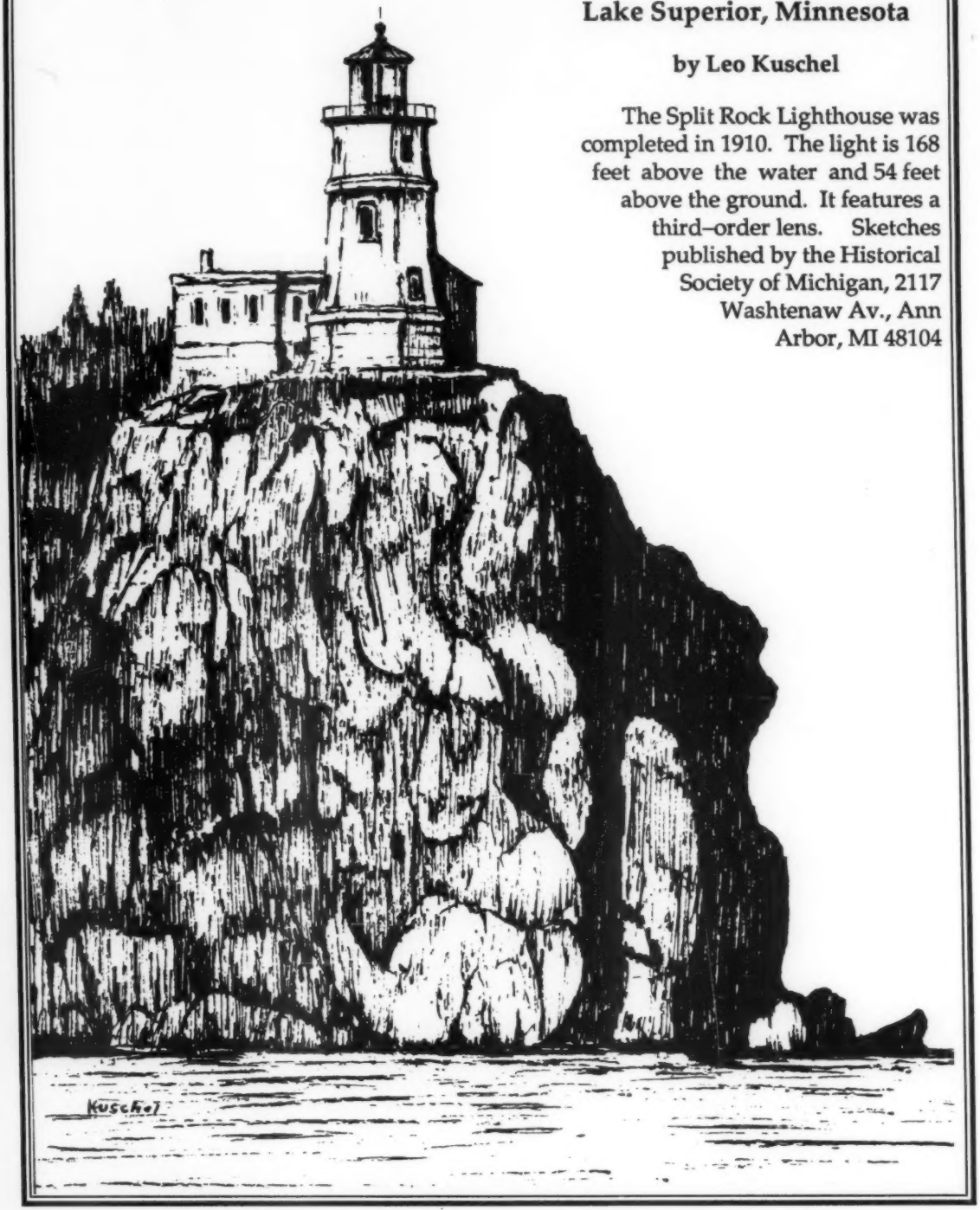
Split Rock Lighthouse

Lake Superior, Minnesota

by Leo Kuschel

The Split Rock Lighthouse was completed in 1910. The light is 168 feet above the water and 54 feet above the ground. It features a third–order lens. Sketches published by the Historical Society of Michigan, 2117 Washtenaw Av., Ann Arbor, MI 48104



Mariners Weather Log

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Editor:
Richard M. DeAngelis

Graphics:
Wilhelmenia L. Bowe

The Secretary of Commerce has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through June 1, 1988.

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Cover: Once guardian of California's most treahcerous bay, the San Francisco Lightship was typical of early vessels with its dual lanterns. U.S. Coast Guard Photo.

Back Cover: Not Winken, Blinken and Nod, but typhoons Gerald, Freda and Holly (left to right) roam the Pacific on September 9, 1987. Photo courtesy of Satellite Applications Branch.

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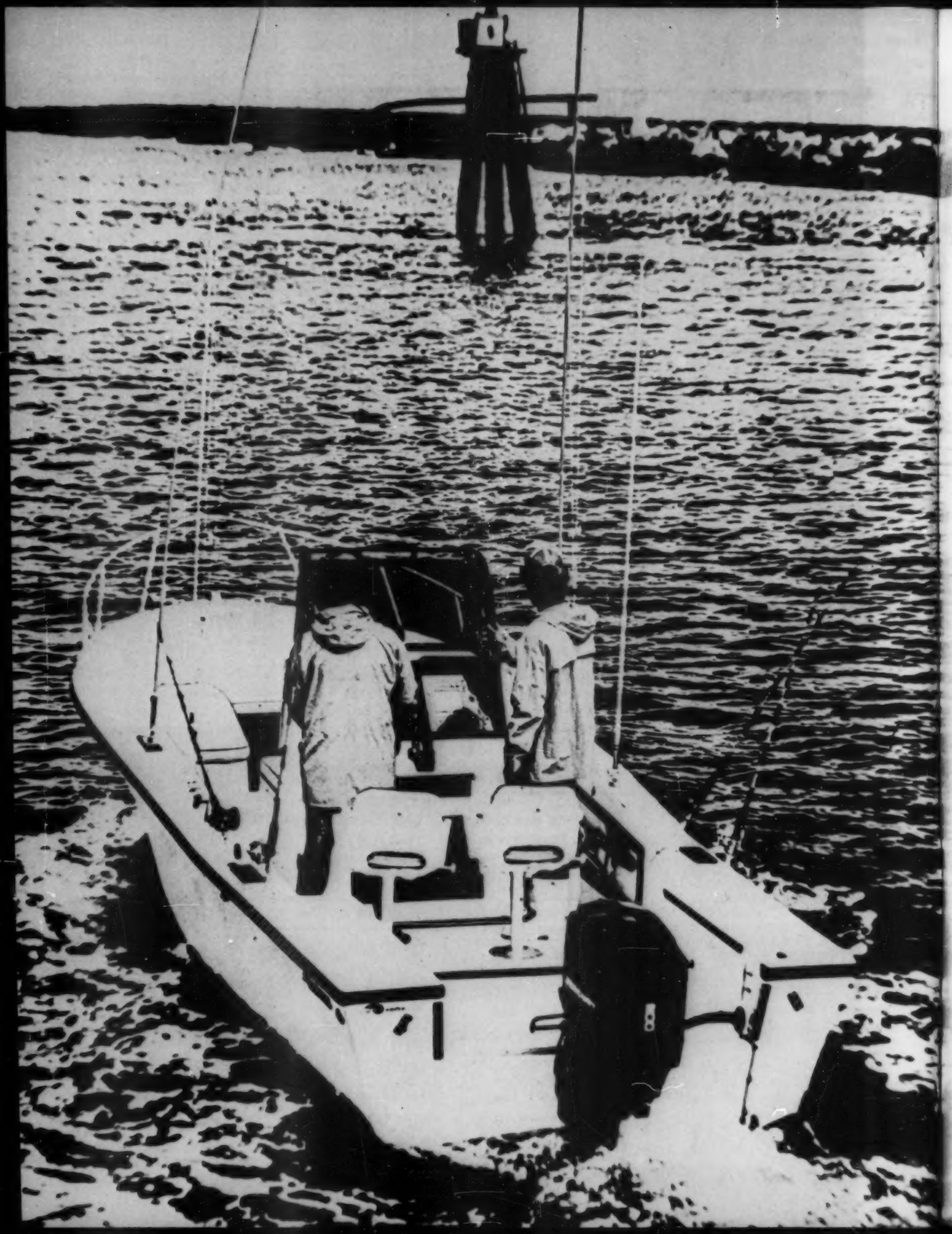


Surf Out the Storm

— by Wendell Roberts, M.D.
graphics by Dorothy Cullinan

In 22 years of offshore fishing in the Gulf of Mexico in small boats, I've seen my share of thundershowers, rough seas and even the occasional squall line, but nothing I ever experienced prepared me for the storm of August 21, 1986.

That summer squall that raced across the Gulf packing 80-knot winds and fast-moving, steep-sided 14-foot seas probably didn't rate more than a paragraph in the Port Aransas paper, but for myself and three fellow anglers in my 22.4 Mako center console trapped eight miles out in the open Gulf, it was a terror-filled learning experience that won't soon be forgotten.

We survived and came home under our own power, but not before we learned some important lessons about what not to do and discovered, more or less accidentally, a survival tactic I call "survival surfing" which worked beautifully and which I feel was responsible for saving our skins.

I am not a complacent or careless skipper. The ***Dorothy-R***, though five years old, was equipped with a new 225 Evinrude V-6 and a 15 hp auxiliary, VHF radio, loran-C, an EPIRB, flare and signal kit, and appropriate PFDs. My crew, Ken Noteboom, Dr. Bob McCurry and Lloyd Laughlin, gathered at my home at 5 A.M. to drink coffee and listen to NOAA weather forecast updates. The forecast called for 2- to 4-foot seas, southeast winds 10 to 15 knots with scattered thunderstorms increasing in the late afternoon. No hint of a major storm.

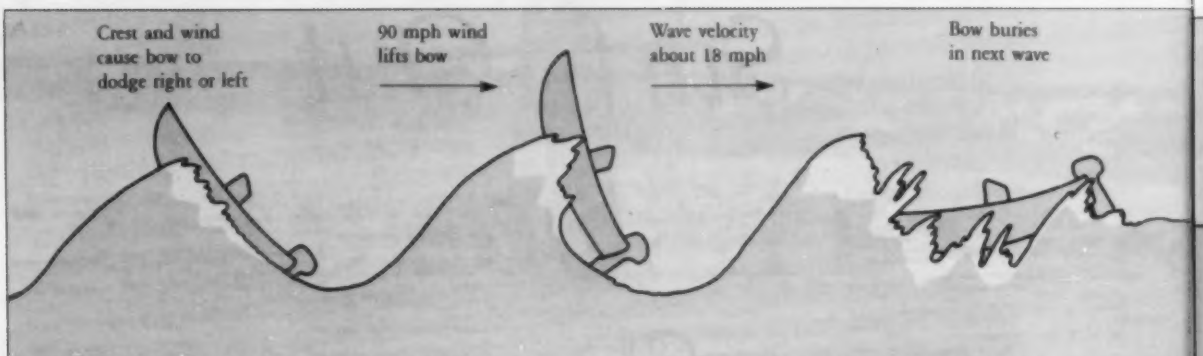
We launched at Aransas Pass and during the 7-mile run down the channel to Port Aransas and the Gulf, we went through a safety orientation, locating for everyone the various safety items. I showed Bob McCurry how to use the loran to come home should I be disabled for some reason, and we even talked through a man-overboard drill.

Most small boat skippers fishing offshore are indeed safety conscious. Furthermore, small boat manufacturers are building a pretty safe boat the past few years with improved hulls and flotation, more range and fuel capacity, reduced fire hazard, and better open ocean capability. The advent of affordable loran- C has extended our fishing world, and we don't think we are foolhardy venturing farther and farther offshore to the deep blue—in our part of Texas 20 to 50 miles off shore— where, as I told my fishing companions that morning—there are sights and beauty few men are privileged to see. If there's the bonus of a sailfish or big dolphin, so much the better. The bad news is that with increased range will come an increased risk of unavoidable heavy weather.

There was a thrill of anticipation aboard the ***Dorothy-R*** as we passed through the Port Aransas jetties out into the open Gulf onto a nearly smooth sea, and watched a glorious sunrise off our port bow. By 9 A. M. we had billfish baits in the water trolling over Aransas and Hospital Banks, large granite underwater outcroppings about 35 miles east of Port Aransas. Later we trolled on, off to about 50 miles out where my wife had caught a trophy sailfish the week before. We had a few knockdowns and caught one bonito but no billfish, but it was still a beautiful day.

"We were blissfully unaware that 29 miles down the road we would be trapped and ambushed by 45 minutes of almost incredibly violent storm ..."

About 4:30 we had worked our way back inshore to Big Southern Banks about 37 miles southeast of Port Aransas, and had a big splashing knockdown, probably a billfish. I was sorely tempted to continue



At first, the author tried to keep the bow into the oncoming waves, but he was unable to control the boat and it almost flipped.

trolling, but thunderstorms were approaching from the east. My crew and I decided to call it a day and head for home. We pulled in the baits, and were soon doing 28 knots over a smooth sea, relaxed and contented and only a little disappointed at our catch. We were blissfully unaware that 29 miles down the road we would be trapped and ambushed by 45 minutes of almost incredibly violent storm which would tax our courage and ingenuity.

As the loran clicked off the miles toward home, I noted a line of thundershowers approaching from my starboard side. When we were 8 miles from Port Aransas, this solid line of thundershowers took on the characteristics of a "wall cloud" of solid top-to-bottom, horizon-to-horizon storm which blocked off our forward progress, and closed in behind us. With Mustang Island on our port side eight miles away, we were trapped. I had no option except to slow to idle speed and try to ease through the storm.

"Racing across the ocean was an enormous wall of huge breakers, their tops whipped into froth by a cold, ferocious wind!"

As I slowed and turned, I was stunned and dismayed at what I saw. Racing across the ocean was an enormous wall of huge breakers, their tops whipped into froth by a cold, ferocious wind! My crew immediately got down onto the deck and donned life jackets. Meanwhile, almost instantly, the wind started screaming, blew my glasses off, and ripped and broke the Bimini top. I was to learn later the Corps of Engineers hopper dredge ***Wheeler***, three miles away, measured 78- knot winds.

With the crew clinging to the deck as best they could, I began trying to ease forward to face the seas bow- first, beginning the first phase of our real-life survival testing.

As the seas built rapidly to a conservative 14 to 17 feet, I experienced more and more trouble controlling the boat. The bow began to dodge wildly first one way and then the other as the ***Dorothy-R*** encountered the breaking wave crests, and we were taking an awful pounding. Finally, an unusually large crest caught the bow and knocked it high into that wind. I had totally failed to anticipate what happened next. The wind caught the bow, lifted, and stood the ***Dorothy-R*** almost straight up and started driving her backwards. For a few split seconds I fought the helm in full lock-to-lock swings of the wheel to keep us straight, and finally the bow fell, but then the bow almost buried completely in the face of the next wave, missing shipping that wave by scant inches.

This was the tactic I had always thought would work, which is commonly recommended, and which nearly killed us. If the wind and sea is bad enough, the "ease into it" tactic makes the boat uncontrollable, and may pitchpole it. Those waves have no backsides, so the pounding becomes intolerable and greatly increases the risk of injury to the crew.

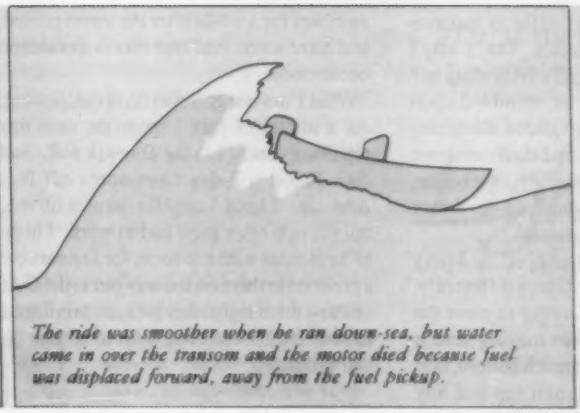
I unhesitatingly did a power turn on the face of the next wave, and began trying to run along with the seas instead of against them. With constant vigilance over my shoulder at the advancing waves, I started manipulating throttle and helm to try to stay out of trouble. Right away there was trouble, as the boat tried to broach first one way and then the other. Too much throttle and the boat tended to bury in the preceding wave, and too little caused broaching and water entering the boat around the outboard even though I had the splash board up.

I hadn't really known trouble, yet, because after only about 2 or 3 minutes, the engine abruptly died! My first thought at the time was that water had splashed up underneath the cowling and shorted out the ignition. Much later I realized that the steep bow-down attitude of the boat had displaced the fuel forward away from the pick-up tube and thus starved the engine, even though I had a quarter tank of fuel. This fuel displacement problem could logically affect any boat trying to run on the face of steep seas.

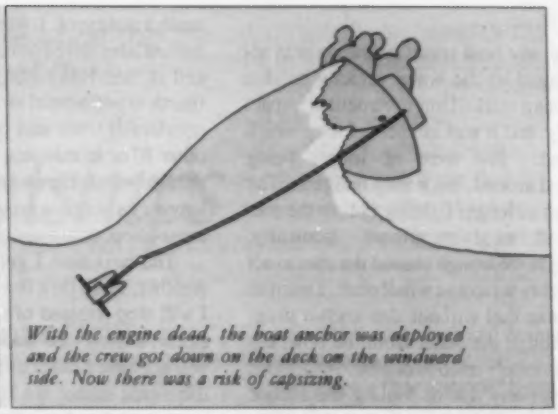
I did not even consider lowering the mounting bracket of my 15-h.p. auxiliary because it would have been instantly submerged by the seas. Instead, I yelled for Ken Noteboom to deploy the boat's anchor tied to the bow.

"We had now been forced into trying tactic number three."

The hope was that the drag of the anchor through the water would give us enough sea anchor effect to pull the bow around and stop the water from entering the boat. An outboard boat has the problem that, without power, it drifts with the bow down-sea and the cut down transom is exposed to the



The ride was smoother when he ran down-sea, but water came in over the transom and the motor died because fuel was displaced forward, away from the fuel pickup.



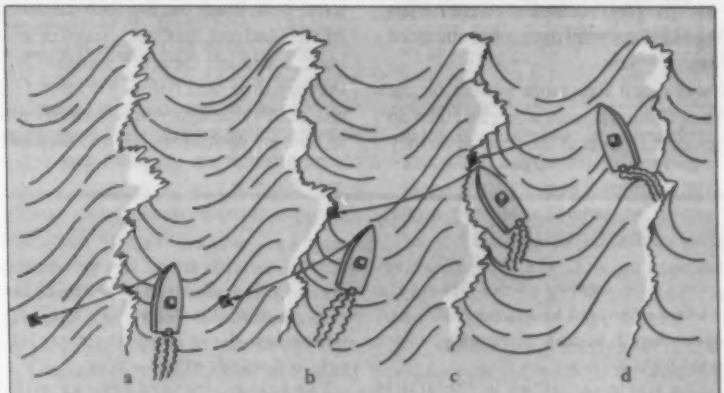
With the engine dead, the boat anchor was deployed and the crew got down on the deck on the windward side. Now there was a risk of capsizing.

following seas. We were now taking water rapidly around the outboard. However, the anchor overboard trick helped.

We had now been forced into trying tactic number three. The anchor's resistance pulled the ***Dorothy-R*** around broad side to the waves and wind. Water now came aboard but drained out successfully, but a new set of problems surfaced. With no power and no steering, seas began crashing violently against the side of the boat. With each wave crest we would be slammed down-sea 5 or 6 feet, and would roll up on our beam end so steeply we had trouble even holding on, and capsize was an immediate threat. We did the best we could, locking the helm full left and shifting the crew to the up-wind side of the deck to counteract the overturning torque forces of the crests. We even threw our weight against the upwind side of the boat just as the crests struck to maximize the resistance to capsizing.

I put out a mayday call on VHF channel 16 so our position and predicament would be known, even though I realized that rescue as such would be impossible in such conditions. Thankfully, I got immediate responses from the Port Aransas Coast Guard Station, the dredge ***Wheeler*** 3 miles away, the ***Sea Harvester***, a 110-foot oilfield supply vessel 7 miles away, and the ***Dolphin Express***, a large party boat 5 miles away. Bob McCurry had to squirm around on the deck to read me the loran-C coordinates because my glasses had been blown off early on and I couldn't read the numbers myself, and he had to help me listen to the radio responses because of the wind noise.

Meanwhile, I held the key in the "start"



To regain control of the boat and avoid the worst impact of the violent, steep seas, the author ran the boat along the troughs (a), roughly parallel to the seas. When a sea threatened to break over the boat (b), he let the bow fall off the wind and the boat slide deeper into the trough. As the seas caught up with the downwind movement of the boat (c), he looked for a "tame" spot in a wave's crest where he could let the wave pass harmlessly under the boat which then slid down into the next trough (d).

position hoping against hope the engine would start. Although the wind prevented me from hearing the starter or the engine, I finally saw blue smoke around the engine, and knew we were back in business. Surprisingly, it ran smooth, and not sputtery or rough as it would have done if the ignition was wet.

During this sea anchor phase I had learned that there are too many uncontrollable variables to this technique to make it a dependable elective alternative. The boat size, the wind velocity, the boat speed, and the wave size and velocity are all variables, which affect the position of the boat when the crest strikes. The suggestion has been made that an ice chest tied to the bow and thrown overboard may help, and it may, but most small center consoles have built-in ice chests. The boat anchor as a sea anchor is a trick worth remembering, especially when you lose your power and have no choice.

With our engine restarted and the boat anchor still streamed from the bow, I put the engine in forward and, reasoning that both easing into the waves and running with them had failed, started an effort to run along in the troughs. There was an immediate and dramatic improvement. With the anchor dragging against the bow, for the first time I had good steering control. The improvement was literally like magic. As I eased the boat along forward and hunkered down behind those 14-footers, I started ascending the wave fronts at about a 10-degree angle, watching the crest for a tame spot. If the crest was breaking heavily, I simply dodged back down into the trough and waited. I would then ease up to the next

wave.

Now, my boat speed sideways was almost equal to the wave velocity so that there was a marked improvement in impact velocity, and it was impact velocity which mattered. We were no longer being whacked around, but gently nudged. The boat was no longer fighting against the seas and wind, but giving ground. Ironically, running in the trough caused the seas to act as a mighty welcome windbreak. I want to emphasize that without that anchor dragging through the water from the bow, the boat was totally uncontrollable. And, there was never any risk of fouling the anchor line with the prop because we were mostly surfing sideways with the anchor streamed upwind.

It was much like those surfers on the shores of Oahu who surf along and then do a kick-out maneuver at the crest when they reach a tame spot. It worked for us, and may indeed have saved our skins. That's why I call it "survival surfing." With this, our fourth experimental tactic, stumbled upon accidentally, we sort of glided along another 10 or so minutes, and then the storm died down almost as suddenly as it began, leaving us bobbing around in a 5- to 8-foot cross-chop, numb and grateful.

The next time I get trapped by heavy weather, I will do a few things differently. I will stop instead of turning to meet the storm, deploy the anchor making sure it will not have a chance to reach bottom, don life vests, secure the Bimini top and any loose gear, break out the flare canister and EPRIB and call the Coast Guard or a large boat. I will tell them my situation before mayday time, and before the loran-C gets confused by the lightning and electrical disturbance. I noticed my loran-C blinked bad numbers for a while after the storm passed, and have since read that this is a common occurrence.

What I am not going to do is quit fishing. As a matter of fact I spent the next day repairing damage to the ***Dorothy-R***, and then fished a 2-day tournament off Port Aransas. Lloyd Laughlin went with me, but the two other guys had to work. I hope to have them with me soon, for I remember a promise to them on the way out to the Gulf to show them sights few men are privileged to see, and I would not want to renege on that promise.

This article was reprinted from the October, 1987 issue of the Salt Water Sportsman, 186 Lincoln St., Boston, MA 02111.
(Photo on page 2 Courtesy of Mako.)

The Squall Line

An opinion as to the type of system that was encountered by the *Dorothy-R* was kindly provied by Michael D. Eilts, meteorologist at the National Severe Storms Laboratory.

"The storm described in the article was most likely a squall line with an associated gust front. A squall line is an elongated line of thunderstorms, which can produce strong winds along its entire length. The leading edge of the strong winds is called a gust front. The "wall cloud" described in the atricle is not what meteorologists describe as a wall cloud; instead, it is called an arcus or roll cloud, and is indicative of the gust front. Roll clouds can extend for tens of miles. Meteorologists refer to wall clouds as the localized lowering (1 to 3 miles diameter) associated with a strong updraft and rotation, and sometimes a tornado, near the backside, or upwind side of a storm.

Although there may be fairly strong winds along the entire length of a gust front, there are local areas which may have stronger winds. This is most likely what the *Dorothy-R* encountered. If while boating you see an approaching line of thunderstorms with an associated arcus or roll cloud, you should seek land if possible. If it is not possible, then you should try to penetrate in areas of less intensity or areas which appear lighter (less rain) along the line. These areas may have weaker winds, since in the marine environment, strong winds are most often associated with the heaviest rain and hail. However, the strong winds can move from their region of origin towards other places.

The best advice is to keep up with the forecasts and weather conditions, and at the first sign of storms, head for shore."

Larger Vessel Action

An opinion as to the response of larger vessels to a similar situation was solicited from Commander Kenneth E. Lilly, Jr. of NOAA:

"Although I have not experienced a violent thunderstorm downburst while at sea, I have felt a 100-knot gust in Alaska while steaming up the Inside Passage in the late 1960s. The ship was a 229-foot, hydrographic survey ship with a 2,000 ton displacement. The effect of the wind was to roll the ship about 10°. High winds, in and of themselves, pose little risk to medium size and larger vessels providing all loose items (e.g., small boats, cargo containers, deck chairs, etc.) are properly secured or stowed. Unexpected, violent gusts, however, pose considerable risk to personnel on deck who could literally be blown overboard. A prudent skipper would make sure his vessel is properly secured prior to entering a violent thunderstorm squall.

In slow speed maneuvering, a ship is very vulnerable to the effects of strong winds. (A single gust of a few seconds duration would not have much effect, but a series of gusts would.) Docking and undocking, anchoring, navigating a narrow canal or beneath a bridge, deploying or recovering equipment or boats, are examples in which a vessel could have serious difficulties. Strong winds can also affect the safety of a vessel while she is moored or at anchor unless certain precautions are taken before the strong winds hit. Wind also affects the loading or unloading of a container vessel, and at some wind threshold, operations are secured.

I'm not aware of the survival technique mentioned by the author being used by ships. Most ships can safely handle 14- to 17-foot seas. Therefore if the technique were used, it would be in very heavy seas and would pose considerable risk to personnel on the foredeck who would have to operate the anchor windlass under hazardous conditions. The only technique I'm familiar with involving the ground tackle of a ship is in slow speed maneuvering. It is feasible to use the anchor on a short haul (just dragging bottom) so that the bow is held in place and the stern is maneuvered with engines and rudders. The anchor used in this fashion is called a "poor mans tug boat."

They were once the Lanterns of the sea.

Lightships

— by Elinor DeWire

No ship was ever pressed into service under greater need than the lightship, yet it remains one of maritime history's least celebrated vessels. It was ungainly in appearance, unpopular with seamen and cursed with a "go-nowhere" mission. An odd commingling of lighthouse, ship, light-keeper and sailor, the lightship struggled to claim its identity in an era when both lighthouse keeping and seamanship were admirable occupations. However, lightship service was afforded the glory of neither.

Its bulky hull and machine-cluttered deck lacked the sloping conical beauty of a headland lighthouse. No graceful stairs spiraled through its interior, nor iron-railed catwalk encircled its lantern. It did not anchor at distant ports as other ships did, and it returned home only for repairs and maintenance. Moored somewhere on the perilous border of land and sea—beacons lit, foghorn blaring and the doldrums of monotony bearing down upon its crew—the lightship gained attention only when it ceased to function.

England Thames River is credited with the world's first official lightship, the ***Nore***, but in the days of Julius Caesar, Roman galleys were known to carry fire-baskets on their masts as guideposts. No doubt other ships hung lanterns aloft and fired guns to signal their fellow seamen, but the single-mastered sloop ***Nore*** was the first recorded ship whose sole purpose was to serve as a navigational aid. Her British designer received a patent in 1731 for the simple 12-foot crossbeam on her mast with lanterns suspended from either end.

The success of the ***Nore*** led to worldwide adoption of the lightship. In river estuaries, where mud and silt would not support a lighthouse foundation, and on harshly exposed rocks and reefs, where lighthouse construction was difficult, the lightship could anchor. It was also cheaper to build than a lighthouse and could be towed into port for repairs and maintenance.

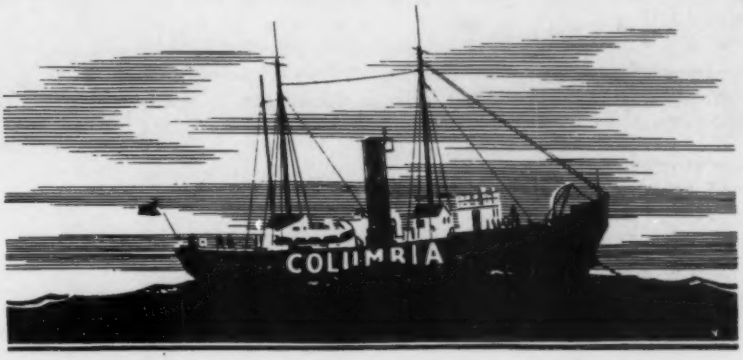
In America in 1731, the lighthouse organization was still young and undergoing tremendous growing pains. It was slow to adopt many progressive ideas in pharology, a science dominated by the British and French whose navigational aids were the best in the world. Nearly 100 years after the ***Nore*** was lit, the United States recognized Britain's novel idea and placed lightships at Willoughby Spit, Virginia and Northeast Pass, Mississippi.

Virginia's lightvessel was moved to the less exposed location of Craney Island late in 1821. There it served successfully and prompted the government to put lightships, at four more Chesapeake sites the following year. Most of these first lightboats had no crew. A keeper, or lamplighter, was paid to row out to them at dusk and dawn to tend their lanterns.

America's first "outside" lightship, or one that guards an exposed deepwater station, was anchored off Sandy Hook, New Jersey in 1823. It had a resident crew and guided sea traffic into busy New York Harbor. "Outside" lightships were also placed at Nantucket and Minot's Ledge, Massachusetts, Diamond Shoals, North Carolina, Carysfort Reef, Florida and Galveston, Texas. The bays, sounds and estuaries between Maine and Texas also received small lightships, but on the West Coast a lightvessel was not lit until 1892.

Initially, lightship design consisted simply of refitting an inactive ship of some type with lighting apparatus and crew. The ***Nore*** had been a cargo sloop, and many of America's first lightships were refitted revenue cutters. However, the lightship was soon designated a unique class of vessel with its own special problems, and architects began designing the lightship as a navigational aid afloat.

Among their considerations were the lightship's exposure to turbulent seas, its dual role as both ship and navigational aid and its need to remain on position. The hull was flattened and bilge keels added to reduce rolling in heavy seas. A huge mushroom anchor, weighing several tons, was installed to hold the ship in place, and living quarters were improved to ease the tensions of unhappy crewmen



marooned at sea on a floating beacon.

Two sizes of lightships, came into initial use. Small vessels displaced 100 tons or less, and larger lightships could go as high as 300 tons. The early lightboats had little or no motive power of their own. Experience with self-propelled lightships, able to keep their position in a storm or return to their position if moorings broke, soon proved the value of motive power.

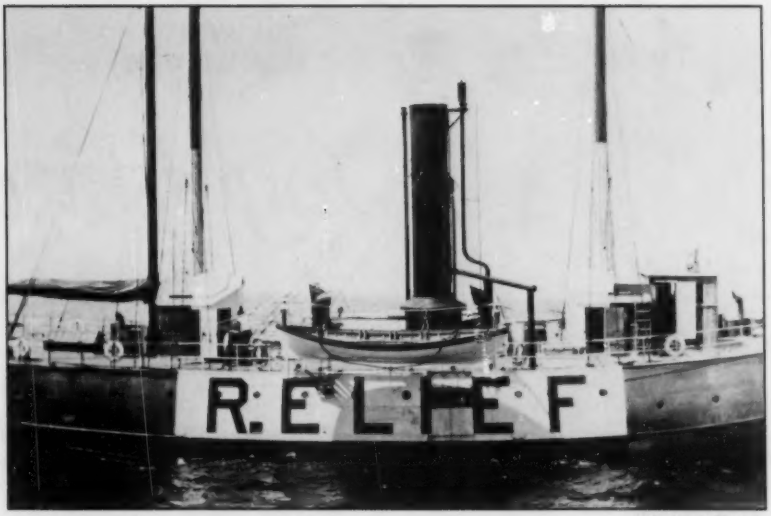
The first self-propelled lightships that appeared about the turn of the century were somewhat impotent, able to creep along at only about 8 knots. Their main concern was service as a navigational aid, hence most of the available space on board was devoted to the fog signal and lighting apparatus.

For many years, wood was the accepted hull material of lightships. Both captains and marine architects believed timber could withstand the seas pounding better than metal, but in warmer waters marine worms were a problem. A Charleston, South Carolina lightship rotted away in only 8 years, plagued by worms, and ***Carysfort Reef Lightship*** off South Florida was eaten through in just 5 years. The careers of wooden lightships were more often thirty to fifty years, especially in colder seas, and only the apprehension of metals stress tolerance postponed the converison to iron hulls.

The first American iron-hulled lightvessel was a refitted revenue cutter placed in service at Merrill Shell Bank, Mississippi in 1847. The problem of marine worms was absent, but limpets and barnacles encrusted her stationary hull. An instrument resembling a large hoe was used to scrape the pesky creatures away, and paint added to inhibit rust. Most lightships were red, but a few yellow, beige and black hulls were in service. They were identified at first by letters and later by numbers. This identification, along with the station name, was painted on the sides of the hull.

"At least one cannon was used as a lightship fog signal..."

The first lighting apparatus consisted of lanterns encircling the masts. These were raised about 25 feet at dusk and lowered into a protective enclosure at dawn. The very oldest were simple oil lanterns with ten to twelve wicks. They rested on gimbals to keep them level as the ship rolled. Improved lamps and reflectors, and fogbells, introduced at lighthouses in the 1820's, were also placed on lightships. Steam fog signals replaced bells about 1850, but most lightships retained a bell as backup in the event of boiler failure. At least one cannon was used as a lightship fog signal—the huge gun aboard the first Diamond Shoals Lightship.



U.S. Coast Guard

Relief Lightship No. 76 (above) was designated to hold down any station while the assigned vessel was away. This vessel spent 56 years along the Pacific Coast.

Some obvious problems surfaced soon after the inception of the lightship design. The first involved keeping position. Heavy anchors and cables moored the lightvessel, and it rotated about them in a radius equal to the warning area. In heavy seas and wind, the ship strained against anchor, and though self-propulsion minimized this problem, it was not a total solution.

Being blown off station was a plight every lightship experienced, but ***Columbia River Lightship #50***, the first West Coast lightvessel, embarked on the strangest lightship journey ever when it parted from its moorings in an 1899 storm. With no means of propulsion, the ship was at the mercy of wind and sea and drifted ashore at Cape Disappointment on November 29th. The Lighthouse Service had given her up for lost when a house-moving company from Portland, Oregon submitted a bid of $17,000.00 claiming it could transport the

Portsmouth Lightship Museum

Portsmouth Lightship Museum

The Portsmouth Lightship (left) has been turned into a museum. Above are the pantry and crew quarters from the Lighthouse.

Portsmouth Lightship Museum

ship one mile overland to Baker's Bay and refloat her.

What followed was one of the most publicized salvage operations in maritime history. In only thirty-five working days, the #50 was moved through the forest and over a hill to the bay. Workmen cleared a path through the trees, and a Wooden Cradle hauled by windlasses supported the lightship as she was pulled across land. She was successfully relaunched in the river and towed to Astoria for repairs. She then assumed her old station where she served until 1909.

Lightship #82, on Lake Erie near Buffalo, New York was less fortunate. A November 1913 storm broke her anchor cables and swept ship and crew into oblivion. In May, she was discovered 63-feet underwater with her interior smashed. A titanic wave had swamped the vessel and filled her interior before lifesaving efforts could be launched. A similar fate befell ***Cuttyhunk Lightship*** off Cape Cod in a 1944 storm. She disappeared completely, and only the bodies of two crewmen and her anchor cable were ever recovered.

Ice was yet another hazard to lightship moorings. Seven Massachusetts lightvessels were torn off position in 1875 by floating ice. Worse however, was the total destruction of ***Cross Rip Lightship*** in 1918. Dislodged and crushed by a floe, she went down in pieces that were later discovered during dredging operations. Neither the bodies of her crew nor her moorings were ever found.

A second problem with lightship duty involved the crew itself. "Temperamental and impatient individuals are not for lightships," wrote author James Gibbs in *Sentinels of the North Pacific*. Life on lightship was both monotonous and terrifying, and crewmen had to be emotionally equipped to deal with the manic-depressive routine of daily lives.

A lightship crew averaged about seven men whose actual workday was only about 4 hours. The men lived in cramped quarters, ate mundane meals and did repetitious jobs without any change in scenery 8 months of the year. They took turns standing watch and doing mess duty, but there was usually only one cook. Meals often consisted of "scouse", a concoction of beef, potatoes, onions and whatever else the cook had on hand. Duff, sometimes flavorfully endowed with dried fruit, was the popular dessert.

Leisure activities were an important part of lightship duty, for there was plenty of time for relaxation. The usual nautical crafts of whittling, knotting and basketweaving were done, and a lighthouse tender brought libraries every few months. Occasionally, crews kept a pet. ***Charleston Lightship #53*** had "Tom", a hefty old tomcat born on the lightship. His duties were simple—the eradication of rodents and the amusement of the crew—but the captain thought of him more as a typical sailor.

"When the boat comes to dock, he'll go ashore, get into a few scraps, and come aboard next morning with scratches and general evidence of having had a night of it. But you may be sure he'll never let the ship leave without him."

Disagreements aboard the lightvessel often came to a head at mealtimes, when men sat face to face partaking of one of the ship's few pleasures. On one vessel, the captain and chief engineer developed such a distaste for each other, they hung a curtain across the table at mealtimes to separate themselves.

U.S. Coast Guard

Blunts Reef # 100 pitches in heavy seas, as it occupied one of the roughest stations in America, west of Cape Mendocino.

More often, seasickness kept shipmates separated at meals. Even the most seasoned sailors became queasy from the ship's ceaseless seesawing and for the weak of stomach, lightship duty was a nightmare. A crewman assigned to the ***Columbia River Lightvessel*** became so violently ill he dropped 20 pounds in a little over a week and had to be taken to a hospital by helicopter. In some instances, crewmen plagued by seasickness were given special amendments to their records excusing them from lightship duty.

The greatest danger for any lightship was not stormy seas or cantankerous crew, but the possibility of collision. Most reckoning vessels steered toward lightships, particularly in periods of low visibility when fog signals were the only means of warning, and collisions were frequent. In fact, before the advent of radar lightships could expect to suffer at least one collision a year. New York's ***Ambrose Lightship*** was unlucky enough to be hit three times in one week, and ***Cross Rip Lightship #5*** was hit fifteen times in its 20-year career. Fortunately, most of these mishaps resulted in only moderate damage and time at a repair depot, but occasional serious losses occurred.

While off Cornfield, Connecticut in 1919, ***Relief Lightship #51*** was rammed by a barge and sunk in only 8 minutes. Her crew narrowly escaped, having drilled faithfully in lifesaving procedures. Fifteen years later, ***Nantucket Lightship #117*** was severed in half in a dense fog by the 47,000-ton liner ***Olympic***. All seven of her crew were picked up, but three later died from injuries.

The ***Nantucket #117's*** demise prompted architects to design lightships that were collision-proof. Watertight compartments and diesel-electric engines, that enabled a ship to get underway in 5 minutes, should a collision be impending, reduced the odds of fatalities. Heavier anchors were added—one weighed 14 tons— and better machinery installed to reel them in. Finally, the silent signal of a radio beacon was given to lightships and a firm warning added about dependence on audible signals during fog.

Improvements aside, the spotlight on lightships was about to go dim. Lightvessel maintenance had become expensive, and manpower was needed elsewhere. The government had shown an established preference for lighthouses all along and progress in lighthouse engineering had already upstaged a number of lightships. ***Minot's Ledge Lightship*** had given way to a huge, wave-swept, masonry monolith. In mucky bays, sounds and estuaries, and on coral reefs, the revolutionary screw-pile lighthouse had sent dozens of lightships into mothballs.

Following WWII, the Coast Guard began a massive reduction in the number of operative lightships, replacing them first with super-buoys and later with huge, well-equipped Texas towers. One by one, American lightvessels went out of service until only the ***Nantucket Lightship*** remained. Many decommissioned lightships were converted to other uses such as fishing boats. Some, like Portsmouth Lightship, were made into museums showcasing the history of the lightship era—a history that for the most part remains unsung.

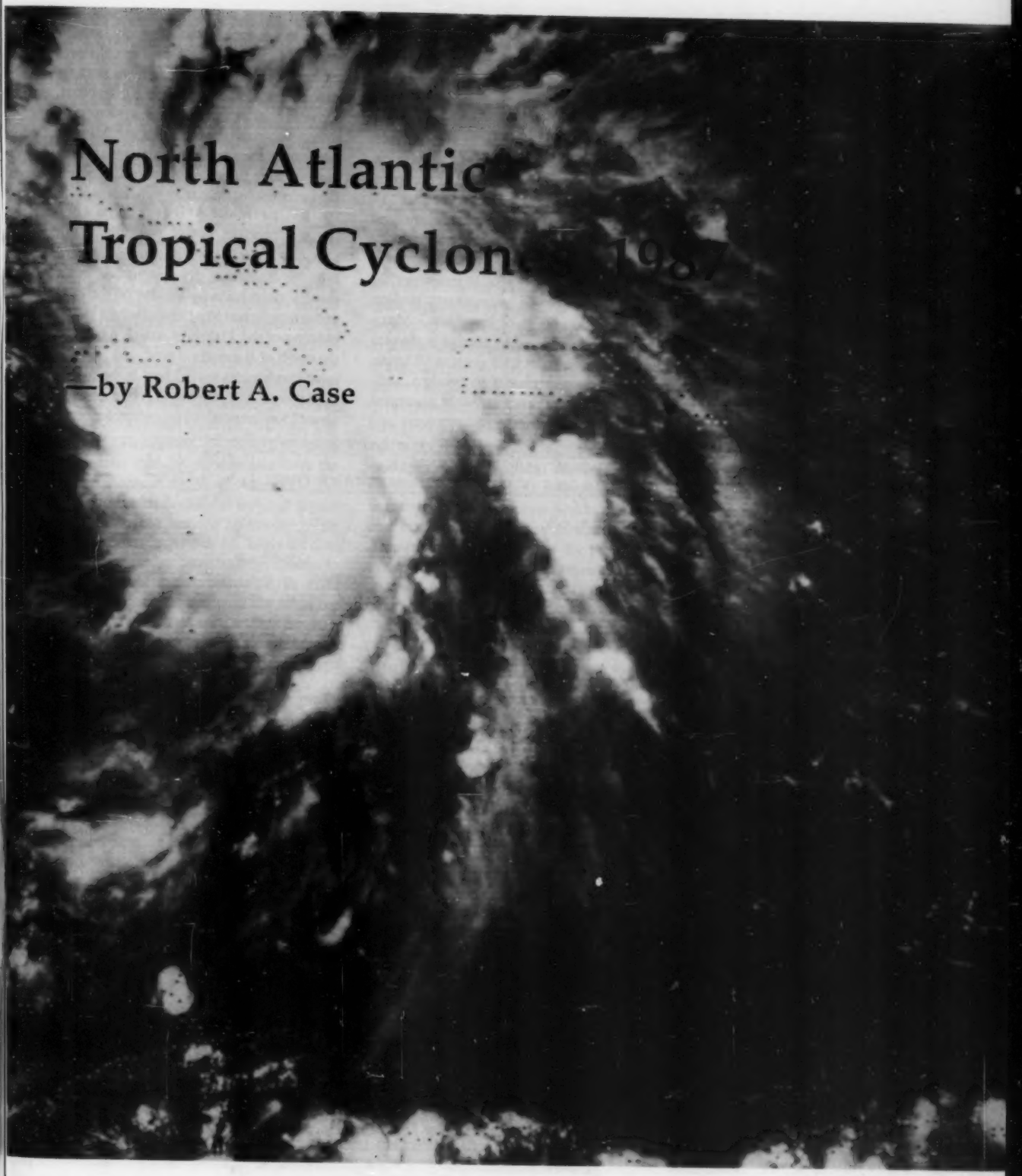
Lightships not only served where lighthouses could not, dropped anchor in waters other ships avoided, and remained on duty when every other vessel ran for port, but also played significant roles in wars, participated in historical events, and taught marine scientists and architects much about the sea. During WWI, Diamond Shoals Lightship#71 discovered a German submarine lurking off the North Carolina coast. Knowing that a number of nearby American warships were unwittingly in danger, the lightship jeopardized its own safety by radioing a warning. The U-boat retaliated by torpedoing and sinking the lightship.

In 1899, scientists, reporters and politicians boarded ***San Francisco Lightship #70***, off the entrance to San Francisco Bay, to witness the first United States transmission of a wireless message. This unusual mission was a success and despite an historic career of which 25% was spent under fog conditions, #70 was sold to private concerns and later sank off Alaska in 1941. Ten years later, the ***Barnegat Lightship*** baffled scientist and seamen alike by surviving a May storm that neatly tied her anchor chain into a perfect overhand knot. The enormous anchor was found intact and close to position. The unexplainable mishap was rectified with the aid of the Lighthouse Tender ***Sassafras*** and a heavy duty boom.

When the career of the ***Nantucket Lightship*** ended, the last of America's active lightvessels disappeared—their gentle, rocking lanterns extinguished forever. In his book, *Keepers of the Lights*, H.C. Adams paid humble tribute to the lanterns of the deep:

"Never in the entire history of the sea have smaller ships and fewer men been entrusted with bigger jobs or performed them with greater credit."

This article originally appeared in the 1984, No. 3 edition of **The Compass.**



North Atlantic Tropical Cyclones 1987

—by Robert A. Case

Four tropical storms and three hurricanes roamed the Atlantic Basin in 1987. This is three hurricanes less than the long term average of about four tropical storms and six hurricanes.

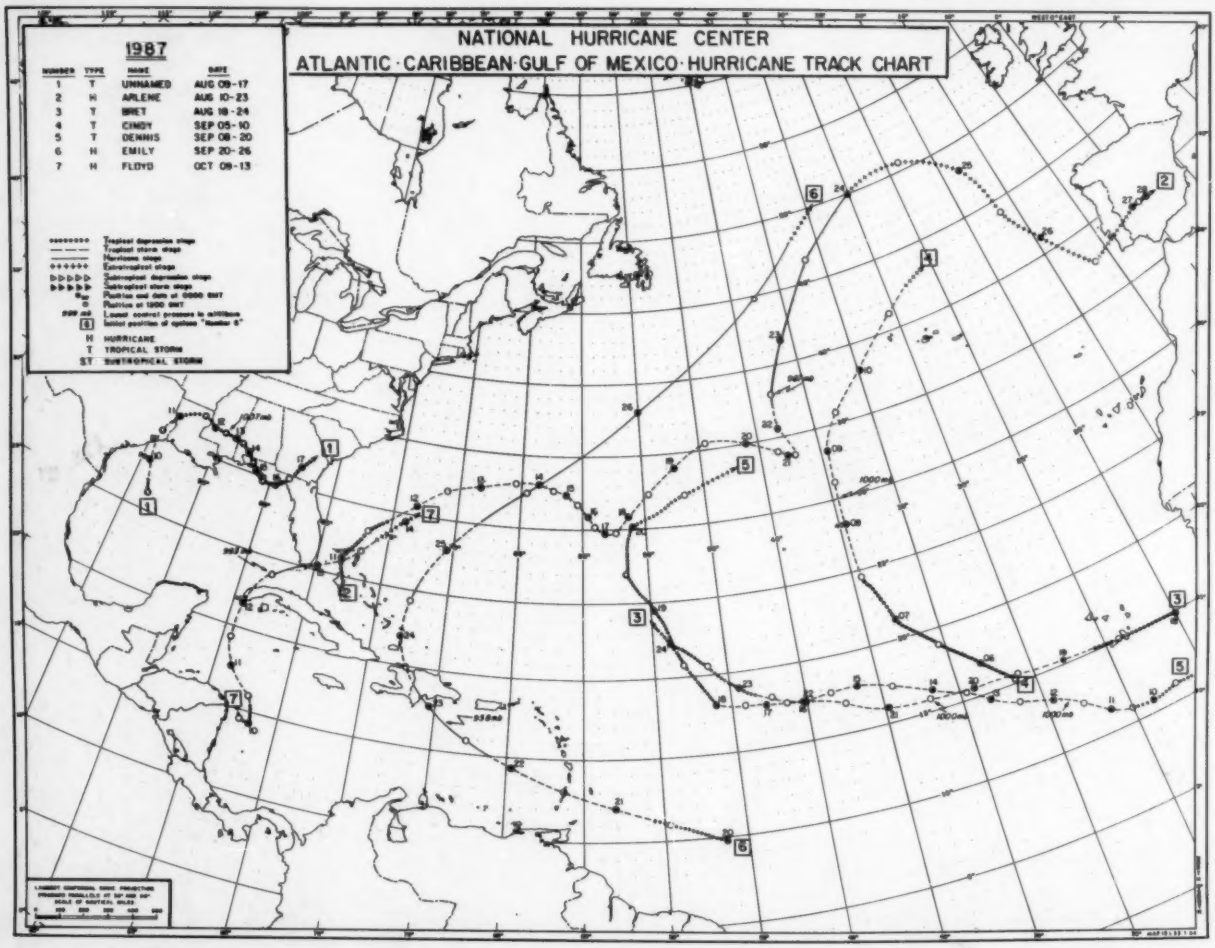
Not only were there fewer tropical cyclones, but they were also weaker than usual. Emily, the strongest hurricane of the season had a minimum pressure of 958 millibars which ranks the 1987 season the fourth weakest in the past 20 years. Three tropical cyclones remained in the eastern half of the Atlantic. An unnamed storm moved onshore within 24 hours after forming. Two of the season's three hurricanes were minimal and Emily, the major one, was a very small system. Therefore, it is not surprising that during the entire season only two ships reported wind speeds of 50 knots or greater that were directly attributable to the tropical cyclones of 1987.

Lastly, in October, a mid-latitude storm (not of tropical origin) slammed into southern England. Winds in excess of 85 knots caused damage that has not been equaled this century.

In light of additional data and a year-end review, **Tropical Depression No. 2,** in the northwest Gulf of Mexico, was upgraded, for the record to a tropical storm.

This system got its start in the northwest Gulf of Mexico on August 9th from the interaction of a tropical wave and an upper-level low pressure center. In retrospect, the depression became a minimal tropical storm within hours of formation. Maximum winds reported by oil rigs in the area were near 40 knots with gusts to 57 knots. The storm was unable to become well-organized over the waters of the northwest Gulf. Most of the heavier showers and thunderstorms moved across the coastline hours in advance of the relatively isolated center of circulation. This tropical storm essentially produced no damage near its point of landfall on the upper Texas coast. However, after landfall this system produced 4 to nearly 9 inches of rainfall over portions of the southeast Gulf states resulting in severe flooding and about $7.5 million in damage, primarily in Mississippi.

Hurricane Arlene began as a low pressure center near the North Carolina coast. After drifting southward into the Bahamas, the system became a tropical depression by midday on the 10th and strengthened to a tropical storm by the evening of the 11th. As Arlene passed to the north of Bermuda it produced 30-knot winds with gusts to 43 knots at the Naval Air Station. Also, the ship *Nivosa* ,located about 35 miles north of the center, reported


NATIONAL HURRICANE CENTER
ATLANTIC · CARIBBEAN · GULF OF MEXICO · HURRICANE TRACK CHART
1987
NUMBER TYPE NAME DATE
1 T UNNAMED AUG 09-17
2 H ARLENE AUG 10-23
3 T BRET AUG 18-24
4 T CINDY SEP 05-10
5 T DENNIS SEP 08-20
6 H EMILY SEP 20-26
7 H FLOYD OCT 09-13
H HURRICANE
T TROPICAL STORM
ST SUBTROPICAL STORM

65-knot winds in heavy weather with a surface pressure of 1002 millibars. However, Bermuda, 50 miles south-southwest of the center, had 25 knots with the same pressure. Based upon satellite presentation showing an exposed center, aircraft reconnaissance reports and the pressure/wind relationship for tropical storms, it was decided that the 65-knot ship report probably was related to localized convection and not representative of the storm circulation.

Arlene continued to meander eastward across the central North Atlantic for the following week. Finally, after reaching hurricane strength (987 millibars) on the 22d, Arlene accelerated off to the north. As the hurricane sped northeastward across the main shipping lanes of the North Atlantic, the ship ***Dolabella***, located about 100 miles to the south southwest of Arlene, reported southwest winds of 50 knots. The hurricane weakened to an extratropical storm later that day as it moved over the colder waters of the North Atlantic.

A well-organized tropical disturbance moved off the northwest African coast on August 17. Early the next day (based on satellite imagery) it became the fifth tropical depression of the 1987 hurricane season. Later on the 18th, the ship ***S.S. Columbus Canterrury*** reported 35-knot winds and a surface pressure of 1004.5 millibars while located just west of the Cape Verde Islands. This observation assisted in the depression being upgraded to **tropical storm Bret.**

The storm moved on a westerly course for the next several days and reached its maximum strength of 1000 millibars, with strongest winds of 45 knots, on the 20th. Thereafter, strong westerly winds in the upper atmosphere destroyed the organization of the storm, and Bret weakened to a depression by the afternoon of the 22d.

The second of three African waves that developed into eastern Atlantic tropical storms moved off the African coast as an area of disturbed weather on September 1st. A major trough (surface to 200 millibars) in the mid-Atlantic began to dig southward on the 4th. The westward-moving cyclone responded to the weakness in the pressure field and began a northward turn prior to reaching 40°W. The disturbance became a depression on the 5th and was upgraded to **tropical storm Cindy** on the 7th. After the storm reached its maximum strength, strong shearing resulting from the approaching frontal trough destroyed its organization. By the afternoon of the 10th, Cindy became extratropical and was absorbed by a large North Atlantic storm on the 11th.

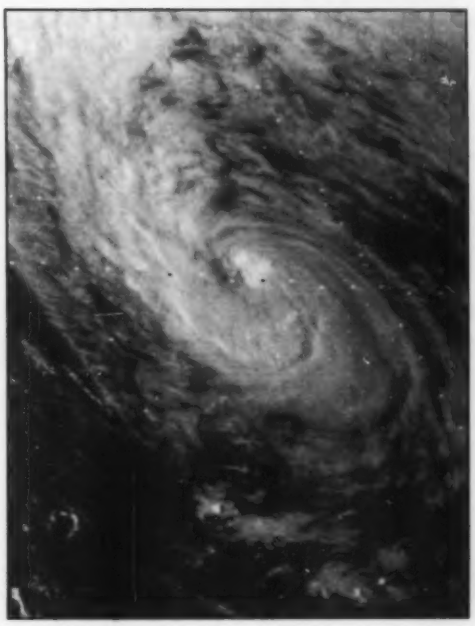
Dennis, the last of the eastern Atlantic tropical storms of 1987, was first detected as a low-level circulation near the African coast on September 8th. Several ships in the area reported south or southwest winds during the 9th and 10th, which confirmed that the low-level cloud circulation observed by satellite was present on the surface. The ship ***Minusinsk***, about 60 miles southeast of the center on the morning of the 10th, reported southwest winds of 15 knots. This combined with satellite imagery indicated the system had reached tropical storm strength. Tropical storm Dennis tracked toward the west-northwest for the next several days reaching its estimated maximum strength (1000 millibars/45 knots) on afternoon of the 11th. Dennis weakened over the next few days as the organized deep convection around the center of circulation was destroyed by the strong westerly winds aloft — similar to the situation encountered earlier by Bret and Cindy. The storm was downgraded to a depression late on the 17th and turned toward the north in response to a weakness in the Atlantic subtropical high pressure ridge. The depression then merged with an extratropical cyclone on the 20th in the central North Atlantic.

Emily moved off the African coast behind the tropical wave that produced Dennis. At first the disturbance remained weak and within the ITCZ (Intertropical Convergence Zone) on its journey across the tropical Atlantic. On the

Hurricane Statistics 1987

No.	Name	Class[1]	Dates[2]	Winds max sus. (kn)	Press low (mb)	Damage US $ mil.	Deaths[3]
1	Unamed	T	8/9–8/17	45	1007	7.5	
2	Arlene	H	8/10–8/28	65	987		
3	Bret	T	8/18–8/24	45	1000		
4	Cindy	T	9/5–9/10	45	1000		
5	Dennis	T	9/8–9/20	45	1000		
6	Emily	H	9/20–9/26	110	958		
7	Floyd	H	10/9–10/14	70	993	0.5	

[1] T: Tropical storm, winds 34–63 kn; H: Hurricane, winds 64 kn or higher.
[2] Dates begin at 0000 UTC
[3] No deaths in U.S.; Emily killed 3 in Dominican Republic; 6 died in floods from Tropical Depression No. 14 in Jamaica.



Page 11: Emily at maximum strength on the 22d of September; right: Arlene at its peak on the 22d of August.

20th, the system detached itself from the ITCZ and developed into a tropical depression some 700 miles southeast of the Windward Islands. When an Air Force reconnaissance aircraft arrived in the area late on the afternoon of the 20th, surface winds were estimated to be 40-45 knots. Once in the Caribbean, Emily began to strengthen rapidly. During the 24-hour period from the afternoon of the 21st to the afternoon of the 22d, the central pressure fell 44 millibars, from 1002 millibars to 958 millibars, a rate of 1.83 millibars per hour. Emily was developing into a strong compact hurricane. During the time of rapid strengthening, about 60 nautical miles to the west of the center, ***Entalina*** reported north northeast winds of only 15 knots and a surface pressure of 1009.6 millibars, compared to Emily's 991-millibar center. The storm was deepening rapidly and developing a small "eye". The hurricane reached a minimum pressure of 958 millibars with 110–knot winds on the afternoon of the 22d. It weakened slightly prior to striking the rural southern coast of the Dominican Republic, between Barahona and Bani, just before midnight.

The storm moved off the northern coast of Hispaniola on the morning of the 23d. It continued to move northward across the Bahamas with little change in strength through the evening of the 24th.

However, Emily again deepened rapidly while accelerating toward Bermuda.

Right: Crew of cruise ship Atlantic uses her anchors and ship's engines to maintain control in the middle of Hamilton Harbor during the height of fast-moving Emily, which is shown (below) within an hour after its 974-millibar eye passed over Bermuda on the morning of the 25th..

Shortly after midnight on the 25th, an Air Force reconnaissance aircraft, located about 215 miles southwest of Bermuda, reported 1500-foot flight level winds of 75 knots and an estimated surface pressure of 985 millibars. Six hours earlier the pressure had been 999 millibars. The cyclone was not only accelerating faster than expected but had deepened rapidly at a rate of 2.3 millibars per hour.

Hurricane Emily, a very small system, passed directly over Bermuda on the morning of the 25th, at a forward speed of 40 knots, with a central pressure of 973.6 millibars. Maximum sustained winds of 75 knots with gusts to 101 knots were recorded at Kindley Field.

Damage resulting in Bermuda from Emily was estimated to be near $35 million. Several people received injuries, but fortunately no lives were lost. Marine interests suffered extensive damage. The cruise ship, ***Atlantic*** , with about 700 passengers on board, broke free of her lines by pulling a cleat out of a dock and then floated into the open harbor. Her alert captain and crew used the ship's engines and anchors to maintain control of the ship and keep it secure in the middle of the harbor during the short period of time(less than 2 hours) it took the hurricane to pass over the island.

Emily continued to accelerate toward the northeast after passing over Bermuda, reaching a forward speed of 55 knots as it crossed 40°N. By the afternoon of the 26th, Emily had become extratropical. However, as the extratropical center of Emily began merging with an intense mid-latitude

NOAA GOES

Floyd's unorganized center (below) is located just to the southwest of Key West on the morning of October 12th. Its circulation extends well off the south Atlantic coast. Floyd was still a hurricane at this time.

EDDIE MARSHALL

storm, hurricane force winds continued to rake the waters of the far North Atlantic. The ship ***Seikyo Maru No. 8***, located about 300 miles south of the combining systems, reported winds of 80 knots. Two other vessels, the FAAA and the D5LW, reported 70– and 50– knot winds respectively.

The second northwest Caribbean cold front of the fall season pushed southward during the first week of October and generated the seedling which produced **Floyd**. A broad area of low pressure formed on the stalled front by the 6th. After meandering in the general area for the next few days, the low pressure center developed into a tropical depression by the 9th. Strong high pressure centered over the United States mid-Atlantic coast, in combination with the depression, produced a strong pressure gradient (20-30 knots) over the waters between the two systems.

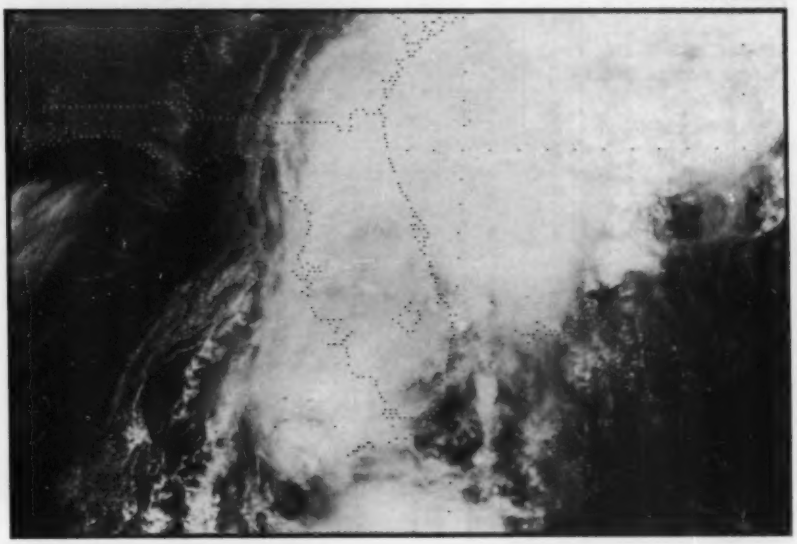
By the morning of the 10th, Air Force reconnaissance and satellite imagery indicated that the depression had reached tropical storm strength. A report of 35-knot winds from the ***Sankomoon***, located just northeast of the circulation center on the morning of the 10th, confirmed that storm-force winds were present at the surface. Later that day the ***Captain Roney***, located south of the center just off the Honduran coast, reported west winds of 35 knots.

Tropical storm Floyd began moving northward on the 10th. During the following 36 hours the ***Chevron Feluy*** , the ***Metallourg Bardine*** and a ship of unknown registry all reported tropical storm force-winds of 40 knots in the vicinity of the storm.

Early on the 12th after Floyd had crossed the western tip of Cuba, a reconnaissance aircraft measured winds of 70 knots at a flight level of 1500 feet, and Floyd was upgraded to a hurricane. However, an approaching trough of low pressure in the westerlies initiated a low-pressure center on a stationary front across central Florida. This development replaced the warm, moist inflow into Floyd with cooler, dry air and turned the hurricane to a more easterly course. As a result the hurricane began to lose its organization as the center moved toward the east northeast through the Florida Keys. Floyd passed south of the Miami area on the evening of the 12th as a disorganized, weakening system.

By the morning of the 13th, downgraded tropical storm Floyd was located just northeast of the northern Bahamas and had began to merge with the low pressure center that had been located over central Florida the previous day. The developing extra-tropical system, in combination with a second large high pressure center located over Ohio, produced northeast winds of 35 to 45 knots over the coastal and offshore waters from the mid Atlantic states to central Florida. The ship ***Gulf Queen***, located just northeast of Cape Hatteras on the afternoon of the 13th, reported the strongest winds of 50 knots from the northeast.

NOAA GOES



North Atlantic Tropical Cyclones

Tropical Storms and Hurricanes											Hurricanes								
	M	J	J	A	S	O	N	D	tot.	Yr.	M	J	J	A	S	O	N	D	tot.
		1	1	2	3	1	1		9	1931					2				2
	1			3	3	3	1		11	1932				3	1	1	1		6
	1	1	3	7	5	3	1		21	1933		1	1	3	3	1			9
	1	1	1	2	2	3	1		11	1934		1	1	1	1	1	1		6
				3	1	2			6	1935				2	1	2			5
		3	2	6	4	1			16	1936		1	1	3	2				7
			1	2	6				9	1937					3				3
				3	1	3	1		8	1938				2	1				3
		1		1	1	2			5	1939				1		2			3
	1			3	2	2			8	1940				3	1				4
					4	2			6	1941					3	1			4
				3	3	3	1		10	1942				3			1		4
			1	2	4	3			10	1943			1	1	2	1			5
			3	2	4	2			11	1944			2	1	3	1			7
		1	1	4	3	2			11	1945		1		1	1	2			5
		1	1	1	1	2			6	1946			1		1	1			3
			1	2	3	3			9	1947				2	1	2			5
	1		1	2	3	1	1		9	1948				1	3	1	1		6
				3	7	2	1		13	1949				2	4	1			7
				4	3	6			13	1950				4	3	4			11
	1			3	4	2			10	1951	1			2	3	2			8
Feb 1				2	2	2			7	1952				2	2	2			6
	1			3	4	4	1	1	14	1953				2	3	1			6
		1	1	2	4	1	1	1	11	1954		1		2	3	1		1	8
			1	4	5	2			12	1955				3	5	1			9
		1	1	1	4	1			8	1956			1	1	1	1			4
		2		1	4	1			8	1957		1			2				3
		1		4	4	1			10	1958				3	3	1			7
	1	2	2	1	3	2			11	1959		1	2		3	1			7
		1	2	1	3				7	1960			1	1	2				4
			1		6	2	2		11	1961			1		5	1	1		8
				2	2	1			5	1962				1	1	1			3
			1	1	5	2			9	1963			1	1	4	1			7
		1	1	4	4	1	1		12	1964				2	3	1			6
		1		2	2	1			6	1965				2	1	1			4
		1	4	1	4		1		11	1966		1	3	1	1		1		7
				1	4	3			8	1967				1	3	2			6
		3		1	3	1			8	1968		2		1	1	1			5
			1	5	6	5	1		18	1969				4	4	3	1		12
	1		1	3	3	2			10	1970	1			1	1	2			5
			1	4	6	1	1		13	1971				2	4				6
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			2	2	2	2			8	1973			1	1	1	1			4
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		1	1	2	3	1		1	9	1975			1	2	3				6
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				1	3	2			6	1977				1	3	1			5
Jan 1			1	4	3	3			12	1978				2	2	1			5
		1	2	3	2	1			9	1979			1	2	2				5
				3	5	1	2		11	1980				3	3	1	2		9
	1	1		2	5	1	1		11	1981				1	5		1		7
		1		1	2	1			5	1982		1			1				2
				2	2				4	1983				2	1				3
				4	6	1	1	1	13	1984					2	1	1	1	5
			2	3	3	2	1		11	1985			1	3	1	1	1		7
		2		1	2		1		6	1986		1		1	1		1		4
				3	3	1			7	1987				1	1	1			3
J–1 F–1	12	31	43	143	194	99	23	4	551	totals	2	13	20	91	121	52	13	2	314

Anatomy of a Monster

A preliminary report on Great Britain's "Storm of the Century"

—by Meteorological Office Advisory Services
Bracknell, Berkshire

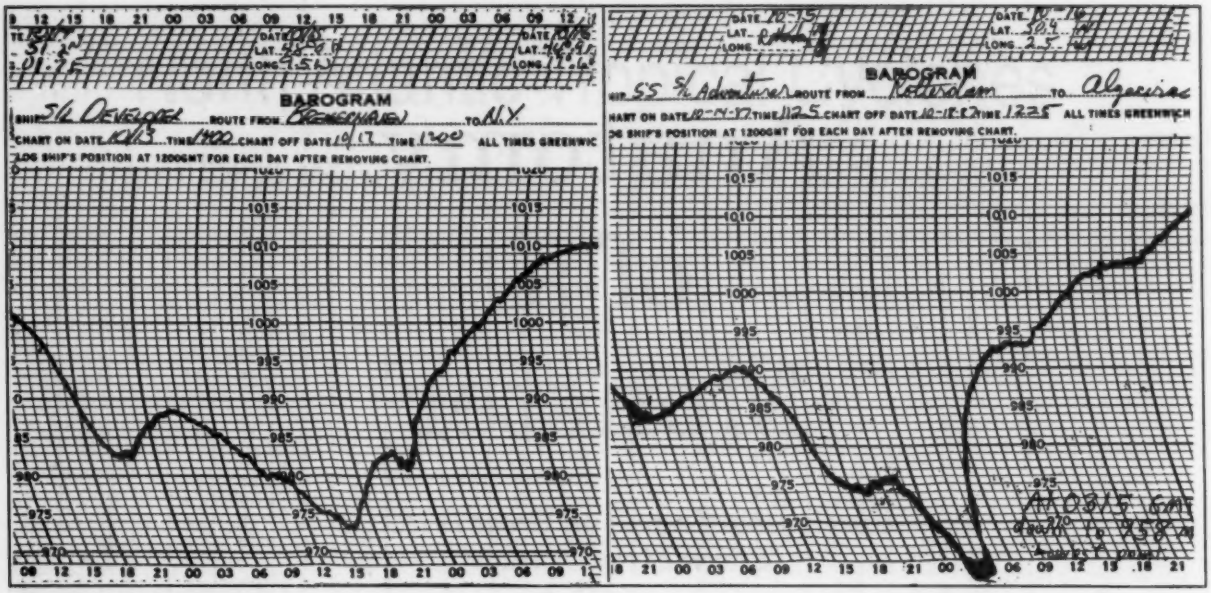
A Londoner starts to chop up a fallen tree in central London, after the worst storm in living memory hit southeast England.

Wide World

A rapidly deepening, intense storm in the open sea, such as February's North Atlantic Monster of the Month, can be disastrous to shipping. In a confined waterway it can be catastrophic.

During the exceptionally bad weather that affected much of northwest Europe and southern England on that dreadful night of October 15-16, 1987, at least 30 emergency calls from distressed vessels were reported by Lloyd's Shipping Intelligence.

The ***Sumnia*** keeled over in 60-knot winds, blocking the entrance to Dover Harbor. Five crewmen were rescued by helicopter. The tim–



*These barogram traces were received from the **Developer**, from Bremerhaven to New York, and the **Adventurer**, enroute from Rotterdam to Algiers. Both hit the Low on the 15th.*

ber carrier ***Redwood***, battered by hurricane force winds in the middle of the English Channel, developed at 35° starboard list when her cargo shifted. The ***Verranzano Bridge*** rescued 4 people off the troubled yacht ***Lyra*** in the Bay of Biscay. The ro-ro ferry ***Hengist*** broke her moorings and ran aground close to Folkestone Harbor, suffering severe bottom damage. And the ill-fated ***Herald of Free Enterprise***, which made world headlines a few months before, broke loose from her tow and drifted recklessly in heavy seas north of Gijion. Hurricane force winds around the port of Cherbourg caused damage to about 60 percent of the 600 yachts in the marina. Other vessels reporting either damage or groundings included the ***Sem 1, Sam G., Tachira, Bredda Prior, Ajax A.S., Corrurf, Othoni, Nikolay Maksimov, Shell Driver, Beechcroft, Stefan Batory, Manjouya, Seafreight Highway, Earl William, Corbiere, St. Christopher, Moray*** and the ***Bibi*** among others.

The nearby coast did not fare any better. The hurricane force winds that swept across southern England blew down 15 million trees. The damage represented 5 months normal British production of softwood and 2 to 3 years of hardwood production. The storm was also blamed for the deaths of more than 20 people in England, who were hit by falling trees and chimneys and in other accidents. Power was out for several days in many areas. Torrential rains caused extensive flooding and some roads were under 4 feet of water. The same storm battered France and Spain, resulting in five deaths. In Portugal torrential rains whipped by gales blocked roads, uprooted trees, cut power lines and flooded neighborhoods. Four people died and nine were injured.

October 15th, 2100 GMT: A 972-millibar Low was centered over the north of East Anglia. From this low a frontal zone lay across the south of England to another depression, which was believed to be centered over the western entrance to the English Channel with a central pressure less than 966 millibars. To the south of the frontal zone the air was quite mild and winds were blowing from between south and southwest. The air to the north of the frontal zone was cooler and winds were from the northeast. Most of the south of England, except the coast of Sussex and Kent, was covered by light to moderate winds from the northeast. Stronger winds from the southwest were already affecting the coast of Sussex and Kent.

October 16th, 0000 GMT: The depression west of the English Channel had deepened, probably to less than 958 millibars and was centered over the south coast of Cornwall. The associated front was being forced to move quickly northwards over the south of England. A broad band of quite heavy rain was associated with the frontal zone. The stronger winds had spread quickly northward over the south of England, backing somewhat to a direction from the south southeast. Gusts to over 40 knots were already being reported over inland areas.

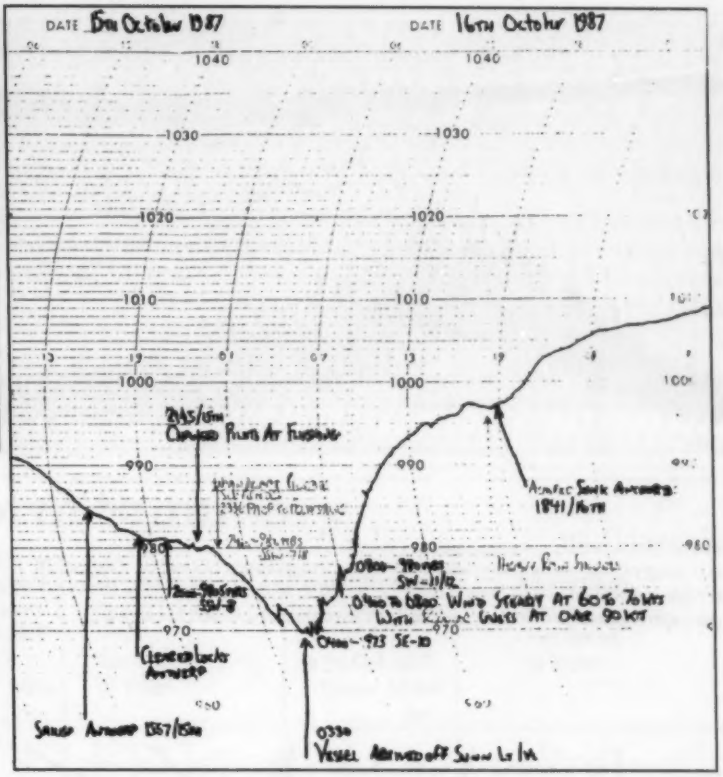
October 16th, 0300 GMT: A 956-millibar storm was over the county of Avon and was moving rapidly northeastward. Gusts of 80 knots or more were being reported at 0400 GMT and 0500 GMT southeast of a line from approximately London to the Isle of Wight. London recorded gusts to 82 knots between 0200 and 0300 GMT.

October 16th, 0600 GMT: A broad belt of very strong winds covered most of England south of a line from Severn Estuary to the Wash. The direction from which the wind was blowing had veered to between southwest and west by this time, as the center of the Low moved quickly away over Humberside. By 0900 GMT winds had decreased in strength over most areas except the north of East Anglia and the low was well out into the North Sea.

Further Information

The October 16th storm will undoubtedly be the subject of more detailed analysis during the coming months, especially as more information is retrieved from recording sites. This summary will be amended by later data. So those who need more detailed reports for insurance, commercial or scientific purposes are advised to contact:

The Met Office Advisory Services
(Room 228)
London Road
Bracknell, Berkshire RG 12 2SZ
Great Britain



M.V. Bibi

Copy of the Barograph trace showing bad weather experienced by the M.V. Bibi on 16th October '87 with Hurricane force winds whilst hove to South of Felixstowe.

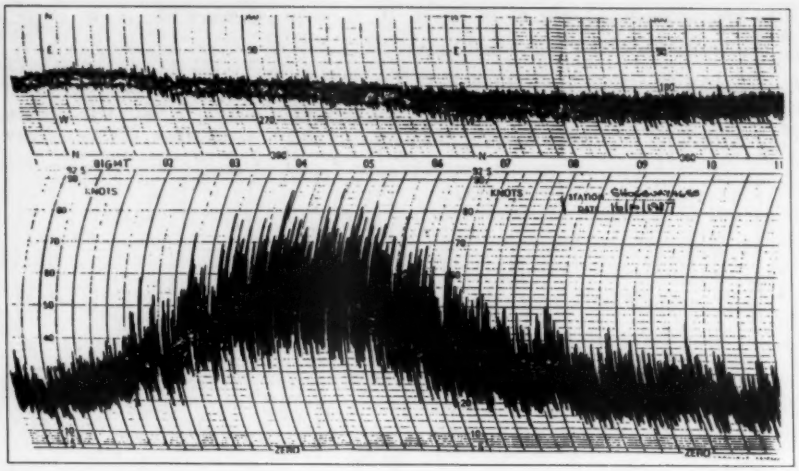
Between the hours of 0400-1200 the vessel steamed into the wind on a course of 210° T. Vessel was using maximum power and speed and was still being pushed astern during the height of the strongest winds, over 90 kts, between 0400 and 0800. Between the hours of 0800-1400 the vessel steamed at Slow Ahead and remained in the same position.

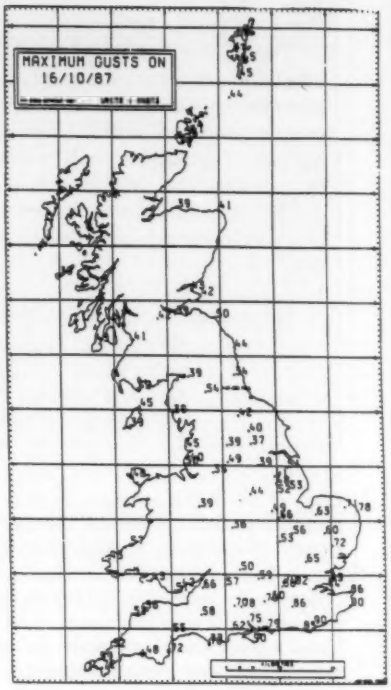
During the afternoon with winds easing to Force 8 vessel allowed to drift astern with engines being put full ahead every half hour for a few minutes in order to maintain safe distance off the Galloper and North Falls banks. With weather moderating during the evening the vessel anchored off Sunk Lt Float at 1841/ 16th October.

M.J. Bellamy, Master

English Tempests of the 20th Century

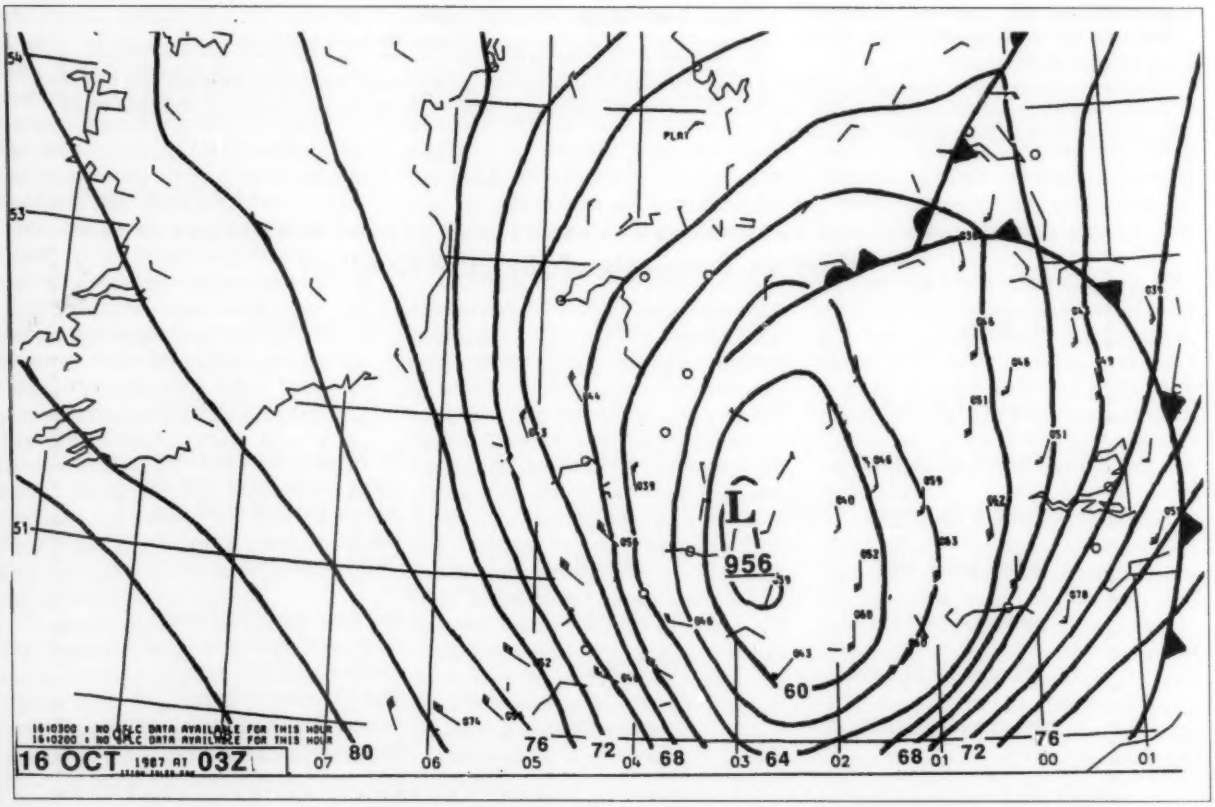
Dates	Area	Characteristics
January 5-8, 1928	All UK	Gale with North Sea floods
January 14-15, 1952	All UK	Severe gale; hurricane force winds over north of Scotland
January 30- February 1, 1953	All UK	Severe NW gale; North Sea floods.
November 4, 1957	All UK	Exceptional gales
January 27, 1961	Scotland	Hurricane force winds over the north of Scotland
February 11-18, 1962	All UK	Exceptional gales; Sheffield storm damage
January 14-15, 1968	Scotland	Exceptional gales; much damage in the Glasgow area





Additional Data

Above is a copy of the anemogram (wind record) for Shoeburyness (Essex) on October 16, 1987. To the right is a maximum gust (knots) chart for the 16th, while the chart below shows the 0300Z analysis superimposed on the wind flow chart. (Chart drawn by Robert Lockerman.)



How unusual were the wind speeds on 16 October 1987?

Providing sufficient long term wind records are available from a weather station with sophisticated wind recording equipment it is possible by statistical methods to estimate the average interval in years between the occurrence of wind speeds of given strength. This interval is known as the **return period.** It must be stressed that the return period is only an average time interval. In reality extreme winds could occur more frequently than the return period. Also the estimation of the return period is greatly affected by the quality and quantity of available data used in the analysis.

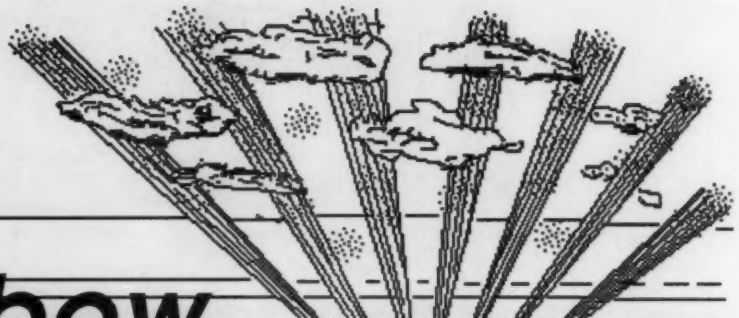
For 19 sites the highest "10 minute" means speeds and/or the highest gusts recorded on 16 October are shown together with an indication of the approximate return periods where available. As can be seen in some areas the wind speeds were not exceptional, having return periods of 20 years or less. However in a few cases the return periods appear to be in excess of 200 years and even possibly as long as 500 years or more in one or two cases. Again it must be stressed that these are estimates and it does not mean that it will be 500 years before such winds will occur again. Nevertheless it does suggest that in some area the wind speeds recorded on 16 October 1987 were exceptionally strong for those areas.

Storm Summary

Station/Area	*Highest Reported 10 Min Mean Speed during 00– 13 GMT on 16 Oct 1987 Knots	Miles /hr	*Approximate Return Period of Mean Speed in Years	Highest Reported Gust Speed during 00–13GMT on 16 Oct 1987 Knots	Miles /hr	Approximate Return Gust Speed in Years
Brize Norton (Oxon)	25	29	Less than 10	50	58	Less than 10
Oxford	35	40	Not available	62	71	Not available
Boscombe Down (Salisbury)	36	41	Less than 10	70	81	20
Hurn (Bournemouth Airport)	37	43	10	62	71	10
Southhampton Weather Centre	48	55	Not available	75	86	Not available
St. Catherines (Isle of Wight)	58	67	" "	90	104	" "
Jersey (Channel Isles)	55	63	10	85	98	15
Herstmonceux (Eastbourne)	60	69	Not available	90	104	Not available
Langdon Bay (Dover)	62	71	" "	90	104	" "
Manston (Margate)	61	70	Over 500	86	99	Over 200
East Malling (Kent)	37	43	Not available	74	85	Not available
Gravesend (Kent)	34	39	" "	74	85	" "
Gatwick (W. Sussex)	34	39	Less than 10	86	99	Over 300
London Airport	39	45	20	66	76	40
London Weather Centre	44	51	200	82	94	120
Stansted Airport	34	39	10	65	75	20
Shoeburyness (Essex)	55	63	Over 500	87	100	Over 500
Wattisham (Stowmarket)	48	55	45	72	83	10
Hemsby (Gt Yarmouth)	45	52	Not available	78	90	Not available

*Strictly the Mean Speed over 1 hour should be used to calculate the return period. However, as such data are not yet available the 10 Minute (synoptic) Mean Speed has been taken as the best available guide.

beyond the rainbow



—by William R. Corliss
P.O. Box 107
Glen Arm, MD 21057

"Unusual Natural Phenomena at Sea"

Ball lightning is one of nature's most mysterious manifestations. Basically, it is a mobile, luminous mass, usually spherical in shape, that accompanies such violent natural phenomena as thunderstorms, tornados, and earthquakes. It is one of those rare natural anomalies recognized by science as real but which eludes all attempts at explanation.

One reason ball lightning resists explanation is that it is so variable. It may be as small as a pea or larger than a house. It may be violet, red, or yellow, or even change colors during its brief life. Ball lightning is generally spherical, but rods, dumbbells, spiked balls, and other shapes have been sighted. Sometimes it appears to have a snake-like internal structure; long crinkled tails may be attached to the balls.

Ball lightning may glide silently and disinterestedly past an observer or it may inquisitively explore a room as if directed by intelligence. While a few of these enigmatic apparitions dematerialize silently, most explode violently. One has to hedge about the location of the sound for the actual explosion sometimes seems to occur elsewhere—outside the house in which the ball lightning has appeared, for example. This observation plus the frequent materialization of ball lightning in closed rooms and metal aircraft suggest that electrical induction may be involved in some cases. In other words, electrical forces from an enveloping thunderstorm may create a glowing ball of plasma in the air inside a closed container similar to the St. Elmo's Fire induced on pointed objects. When the electrical forces disappear (usually with a peal of thunder), the ball lightning vanishes, too. Observers, however, have no doubt that something palpable has visited them because the room is usually filled with the smell of electricity (ozone), and there may be smoke and much material damage.

No reasonable explanation exists for ball lightning. Glowing spheres of plasma created by natural electromagnetic forces have been proposed and found wanting. Antimater meteorites, chemical reactions in the atmosphere, and intense cosmic radiation have also been proposed. None seems adequate. The sheer difficulty of accounting for ball lightning has led some scientists to assert that all observations of this phenomenon are illusory—aberrations of the eye and brain. But photographs of ball lightning do exist, and thousands of seemingly sound observations exist in the literature. Ball lightning seems very real.

Ball lightning or globe lightning was long doubted by scientists. Observations, even by reliable and competent individuals, were rejected as optical illusions or misidentifications of other natural phenomena. Yet, so many good observations have occurred in recent years and our knowledge of plasma physics has advanced so much farther that the reality of ball lightning is now generally accepted. The explanation of this phenomenon, however, still eludes us. Ball lightning's shape and stability can probably be explained by the relatively new field of plasma physics. In other words, some sort of electromagnetic bottle confines the essential substance and energy. Early scientists thought that the substance of ball lightning was probably only combustible gas, but calculations show that much higher energy densities

Ball lightning as depicted by an old woodcut from ***L'Atmosphere*** *by C. Flammarion (Paris, 1873) provided by the Burndy Library.*

than those in, say, methane, are needed. It is fashionable now to talk in terms of highly energetic metastable states of molecules. Some of the examples classified as ball lightning below may actually be only unusual cases of St. Elmo's Fire and corona discharge—especially those that seem to simply fade away without a detonation.

In 1843 in France came this report of ball lightning. 'After a loud thunderclap, the tailor finishing his meal, saw the chimney-board fall down, as if overset by a slight gust of wind, and a globe of fire, the size of a child's head, come out quietly and move slowly about the room at a small height above the floor. The tailor said it looked like a good-sized kitten, rolled up into a ball, and moving without showing its paws. It was bright and shining, but he felt no sensation of heat. The globe came near his feet, like a young cat that wants to rub itself against its master's legs; but by moving them aside gently, he avoided the contact. It appears to have played for several seconds about his feet, he bending his body over it and examining it attentively. After trying some excursions in different directions, it rose vertically to the height of his head, which he threw back to avoid its touching his face. The globe, elongating a little, then steering towards a hole in the chimney above the mantlepiece, which hole received a stove pipe in winter, but was now pasted over with paper. 'The thunder,' he said, 'could not see the hole,' but nevertheless, the ball went straight to the aperature, removing the paper without hurting it, and make its way into the chimney. Shortly afterwards, and when he supposed it had time to reach the top, it made a dreadful explosion, which destroyed the upper part of the chimney, and threw the fragments on the roofs of smaller buildings, which they broke through."

In addition to the numerous sightings on land there have been several at sea. "Capt. Grace, of the schooner ***Rebecca Smith***, on August 10, 1888, during squally weather with thunder and lightning and heavy rain, observed a bolt of lightning in the shape of a ball fall in a perpendicular (zig-zag) line from the zenith and strike the surface of the water less than a length from the vessel's beam. There was apparently no disturbance of the surface when the lightning struck (although this might have been missed in the glare of the lightning), but for a space of at least five minutes after the lightning struck, a thin blue smoke, similar in appearance to powder smoke, was seen to rise from the surface to a height of at least ten feet.. The smoking surface was generally circular in form, about twelve or fourteen feet in diameter, and had the spot in which the ball struck for a center. the occurrence took place in broad daylight."

In the North Atlantic, in 1850, a fireball shattered a ship's mast while in 1861 three luminous bodies appeared on the sea during a squall. On June 30, 1867 in Hudson Bay a fireball fell on a ship shattering a mast. In September 1880 ball lightning fell into a pond in Hendon, England killing more than 100 fish. In 1881 off Scotland a chain of unconnected balls of lightning were observed over a ship. Each was about a foot in length. Several other fireballs were seen running around the ship. On March 6, 1892 in the North Atlantic a luminous ball burst on a steamer spreading lightning in all directions. A few months later on July 3, in Liverpool England, ball lightning was reported falling into a lake creating a column of water 60 feet high. On the 6th of April 1889 a fireball ran down a rigging and burst above the deck while in July of the same year ball lightning fell on a ship glided around the deck and rigging and then exploded. There have also been numerous occurrences in this century. In the North Atlantic, on February 10, 1975, an intense bluish-white fireball exploded after 5 to 7 seconds. On May 1, 1980 in the Arabian Sea an orange fireball traveled horizontally over the water accompanied by a great deal of static electricity. In the North Atlantic on February 16, 1957 a blue fireball fell from a cloud and shot across the vessels bow at sea level.

marine observation program

—by Martin S. Baron
National Weather Service
Silver Spring, MD 20910

Corrections

There were two typographical errors in the marine observations program article, fall, 1987 MWL, page 20. First, when discussing what to do if the tenths value of the dry bulb temperature is not available, a (1) was accidentally printed instead of a (/). Use the slash (/) when not reporting in tenths. Second, in the discussion on reporting wind and clouds in complete darkness, group $1S_nTTT$ was incorrectly printed as IS_nTTT. It was pointed out that group $1S_nTTT$ and all remaining groups are optional—if you don't have data for any of these groups, skip over them (never transmit them as 2//// 4// // and so on). The groups before $1S_nTTT$ are mandatory, and you must use slashes for any missing information here, including entire groups of missing data.

WMO Cloud Charts Now Available

A limited number of cloud charts, prepared by the World Meteorological Organization, are now available from the PMO'S. The charts contain 38 cloud photo's taken over the sea, and are arranged by height (high, middle, and low level). Each photo is labeled with the numerical synoptic code figure for cloud type used in the weather message (always 0-9 or slash (/) if not visible).

New Marine Observations Specialist in Anchorage

Andrew Brewington has been selected as the marine focal point for the National Weather Service (NWS) Alaska Region. Andy was born in Williamsburg County, VA and grew up in Florence, SC. He spent 9 years in the Air Force, and earned an Associate Arts Degree. His duty assignments were at Myrtle Beach, SC, Tuscon , AZ, Urdorn, Thailand, Duluth, MN, and Chanute, KS. He joined the NWS in 1978, and has worked in the observation and forecast programs at NWS Offices in Ann Arbor, MI, Barter Island, AK, Barrow, AK, and Des Moines, IO. In 1984, he was chosen to be the official in charge at the NWS office in Cold Bay, AK. Andy and his wife, Lonnie Kay, have 3 children and a granddaughter.

Andy Brewington is the new Marine Observations Specialist for Alaska.

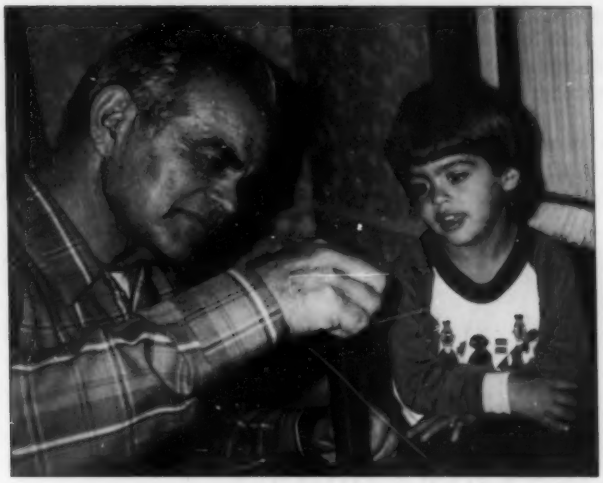
Newark PMO To Retire

Joseph Takach, PMO in Newark, NJ retired as of January 2d. Joe began his meteorological career with the Naval Weather Service in 1948. He began working for the National Weather Service in 1954 at the Extended Forecast Section of the National Meteorological Center in Washington, DC. In 1957 he transferred to the Atlantic Weather Project. In 1973, Joe took a position at the Weather Service Meteorological Observatory in Patuxent River, MD. In 1974 he transferred to the Newark, NJ office. He became PMO in September, 1982. Joe and his wife Lois have five children and reside in Stockholm, NJ.

Los Angeles PMO to Retire

Anthony Rippo, PMO in the Los Angeles area, will retire January 2, 1988. Tony has served as PMO in the Southern California area for the past 29 years, and will be greatly missed by the entire Marine Observations Program staff and the marine community. He has made over 55,000 ship visits, a record not likely to be matched. Vessels that he has recruited and serviced have made some 5 million synoptic weather observations over the years, in support of marine weather forecast operations worldwide.

Born and raised in San Pedro, Tony first went to sea on a Merchant Marine tanker from that port. While still a teenager, he was a crewman on board a tuna boat out of San Diego. During World War II, he left the Merchant Marine and served as a weather observer with the U.S. Air Force. After the war, Tony worked for the U.S. Weather Bureau as a weather observer and radiosonde operator on ships in the Pacific



Tony Rippo's new retirement position.

Weather Project. He was placed in charge of a Weather Bureau unit on a research vessel of the Scripps Institution, and later supervised similar units on ships of the Merchant Marine, Navy, and Coast Guard. He also supervised weather reporting programs of the North Pacific Ocean Station Vessel Program.

Tony became PMO In San Francisco in 1957, and transfered to the Los Angeles area 2 years later. In 1974, he received the Department of Commerce Bronze Medal for "individual leadership in the program to recruit cooperating ships into the marine weather reporting service". Tony and his wife, Ollie, have one son and a grandson. The Rippos' are planning to remain in the Long Beach area. Their address is:

11456 Harrisburg Rd.
Los Alamitos, CA 90720

Changes to Ship's Synoptic Code

The World Meteorological Organization (WMO) Commission For Basic Systems, which sets code policy, has just made two code changes, the first since 1982 — concerning the reporting of high speed winds of 99 knots or greater, and the use of code figure 9 (sky obscured) when reporting total cloud cover. These changes are described below. Late in 1988, an updated version of NWS Observing Handbook No. 1 will explain all program changes. The current edition of the handbook was prepared in 1982 when the WMO fully revised code format FM 13–VII Ship, used by vessels worldwide to report weather.

When reporting windspeeds of 99 knots or greater, we no longer add 50 to dd and enter the tens and units digits as ff. Instead, the actual windspeed in knots is reported using a new group, the high speed wind group (**00fff**), immediately after the group **Nddff**. **00** is the indicator for the high speed wind group, and fff is the true windspeed in knots. When **00fff** is included in ther weather message to report a high speed wind, ff in the group **Nddff** is coded as **99**. This new group is only used to report high speed winds. When reporting winds of less than 99 knots, the group is omitted from the weather message. Here are three examples:

(1) The wind is from 230° at 25 knots. In the group **Nddff**, **ddff** is coded 2325. The group **00fff** is not included.

(2) The wind is from 230° at 99 knots. In the group **Nddff**, **ddff** is coded 2399, and the group **00fff** is coded **00099**.

(3) The wind is from 230° at 112 knots. In the group **Nddff**, **ddff** is coded 2399, and the group **00fff** is coded 00112.

When reporting total cloud cover, code figure 9 was formerly defined as "sky obscured or cloud amount cannot be estimated." The slash (/) was defined as "no measurement made." Under the new definitions,use code figure 9 for "sky obscured by fog and/or other meteorological phenomena." The slash (/) is now defined as "cloud cover indescernible for reasons other than fog or other meteorological phenomena, or observation is not made." The slant would be used, for example, if the observer could not see the sky due to bright lights at night.

Since NWS Handbook No. 1 was published in 1982, we have had a name change. The NWS program is now known as the Voluntary Observing Ship Program, rather than the Cooperative Ship Program. This change was made to conform to the name used by the WMO for shipbboard weather reporting programs, and to avoid confusion with another NWS program—the Cooperative Substation Program, a land based network of climatological stations.

Both NWS forms used by moving ships to prepare weather observations have had their number designations changed. "Ship's Weather Observations", is now WS Form B-81. In 1982, it was NOAA Form 72-1A. "Weather Report For Immediate Transmission", now WS form B-80, was NOAA Form 72-4A in 1982. If you still have supplies of form 72-1A or 72-4A, they can be used, but you should ask your PMO for the new forms at the first available opportunity. Any other versions of these forms follow the old code format and cannot he used.

Two important changes concerning the transmission of weather reports have occurred since 1982. First, you can now send your weather messages through the INMARSAT system. A special weather channel, code 41+ has been set up. Instructions for using this channel have appeared many times in the MWL. Second, if you are using a commercial shore based relay station (only when contact with a U.S. Coast Guard station cannot be made), the NWS asks that you combine all weather message groups following the ship's call sigh into "ten character groups." This saves money—the NWS is charged according to the number of groups in the message.

The VOS program has had many changes in personnel since 1982. Please consult the inside back cover of the MWL for current PMO names, addresses and phone numbers.

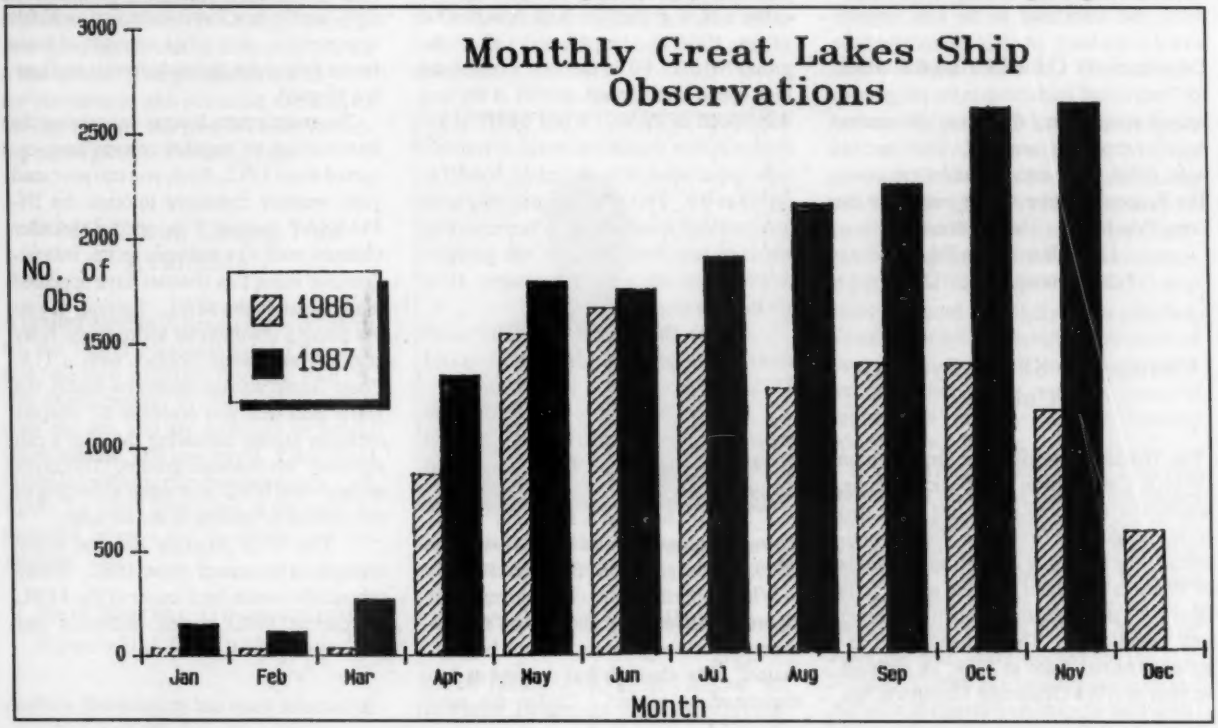
PMO report

—by Bob Collins
National Weather Service
Chicago, IL.

Great Lakes Observations

It's a pleasure to report that the number of weather observations from vessels on the Great Lakes is on the rise. This trend has added significantly to the data base required to produce quality forecasts. The number of weather observations received just from the Chicago office have more than doubled over last year's figures. As a result, several computer products are generated more often than in the past, with hopes of providing more forecast information, faster.

The key, however, to the cyle of observation and forecast product output is the **Weather Observation.** Without quality observations from dedicated vessels and crews, we could not provide the service you have become accustomed to and deserve. The observation is at the very core of the forecast. It's a pleasure to see so many Great Lake's vessels reporting at the 3 hour



interval as it provides the information needed to identify and respond to rapid changes so often experienced on the Lakes.

The forecast process needs as much data as possible. In medicine, the better and more complete the physical examination the better the chances of a proper diagnosis. Weather forecasting operates in much the same way. Your observations are the physical examination of the Lakes, upon which the forecasters make their diagnosis and forecast. The better the exam the better the diagnosis.

Quality observations are important. As one of the mates from the ***George A. Sloan*** said, "Garbage in, garbage out." The problem when dealing with the weather is that "garbage in, garbage out" can have a direct and dramatic impact on every vessel on the lakes. With good observations taken more often, better forecasts and more timely updates can be provided.

Bob Collins

*The **Charles M. Beeghly** is one of our finest Great Lakes Observing Ships. Here she is being assisted down the Calumet River after loading coal at the Rail to Water Transportation Co. in Chicago, IL.*

the mail bag

Dr. Albert G. Ballert, Director of Research for the Great Lakes Commission, has always been a dependable contributor of information and photographs for the Great Lakes. This year he has kindly sent some tables and photos that should be useful to anyone interested in the Great Lakes.

The sequence of damage and protection photos on page 29, were taken at Luna Pier, MI, which is at the west end of Lake Erie, over a period of 15 years:

(1) In early 1973 the lakefront was protected by an ice barrier.

(2) Wave–damaged homes after the April 9, 1973 storm when the lake level elevation exceeded 775 feet (long term April mean is about 571 feet).

(3) Temporary protection .

(4) Rock boxes, which were erected and filled with rock by the U.S. Corps of Engineers.

(5) The seawall completed in 1986, replaces the rock boxes.

The 1000-foot Stewart J. Cort upbound in the Poe Lock at Sault Ste. Marie, MI. During the 1986 season the 1000-footers made 400 transits enroute to the lower lakes.

GREAT LAKES BASIN PRECIPITATION FOR PAST TWO DECADES, 1967-1986 AND AVERAGES FOR 1900-1986, 1900-1986 AND 1977-1986

Data in inches for each lake drainage basin (Erie includes St. Clair basin)

Year	Superior Basin	Michigan Basin	Huron Basin	Erie Basin	Ontario Basin	Great Lakes Basin
1967	28.42	33.33	36.66	34.96	36.08	33.35
1968	37.96	34.29	33.94	36.57	36.83	35.82
1969	27.73	31.56	32.98	36.14	34.01	31.78
1970	33.84	32.86	34.94	34.23	36.42	34.25
1971	33.45	30.10	31.25	28.97	32.66	31.43
1972	32.22	34.97	35.32	39.70	43.67	35.97
1973	30.84	33.98	33.33	37.04	38.16	33.87
1974	23.85	32.77	25.91	34.15	33.40	28.94
1975	29.81	35.74	34.59	38.94	38.54	34.62
1976	25.97	26.54	33.43	35.88	40.92	31.06
1977	39.93*	34.42	37.04	42.79*	44.26*	38.84
1978	30.99	33.67	31.38	32.38	34.08	32.25
1979	35.69	33.18	35.78	38.62	38.21	35.86
1980	29.59	32.11	33.90	35.86	36.87	32.93
1981	28.37	31.51	32.30	39.35	38.16	32.69
1982	35.82	32.86	34.34	36.67	31.42	34.39
1983	32.27	31.55	36.93	38.26	31.46	33.97
1984	29.09	29.74	36.65	35.26	30.91	32.15
1985	38.25	38.98*	42.36*	42.31	39.78	40.16*
1986	32.21	34.71	35.99	40.79	41.86	36.01
* Record Year						
Averages						
1900-66	29.40	31.12	31.13	33.69	34.13	31.36
1900-86	30.01	31.51	31.85	34.41	34.73	31.98
1977-86	33.22	33.27	35.67	38.25	36.70	34.93
Above 1900-1986 average						
1986 %	+7	+10	+13	+19	+21	+13
No. of yrs. in past 2 decades	12/20	16/20	16/20	16/20	12/20	15/20

January-June 1986, 1987 and Average Precipitation

	Superior Basin	Michigan Basin	Huron Basin	Erie Basin	Ontario Basin	Great Lakes Basin
1900-86 Avg.	13.06	14.68	14.47	16.97	16.59	14.76
1986	13.52	13.41	14.79	18.04	17.82	14.92
1987 (provisional)	8.10	9.90	11.02	16.22	14.90	11.12

Sources:
U.S. Dept of Commerce, NOAA
Great Lakes Acquisition Unit
U.S. Army Corps of Engineers, Detroit District

Prepared by:
Great Lakes Commission
2200 Bonisteel Blvd.
Ann Arbor, MI 48109

Damage and Protection at Luna Pier, MI

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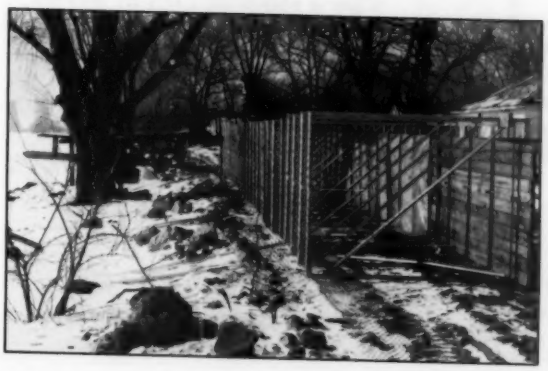

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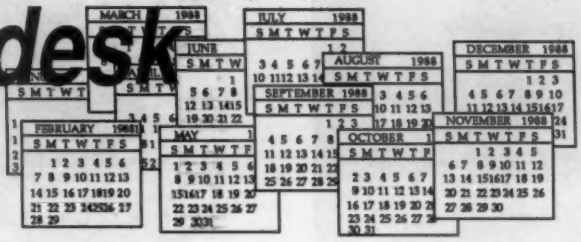
the editor's desk



Buoy Article Correction

In Glenn Hamilton's Buoy Records article which appeared in the Fall 1987 issue, I made a mistake in labeling the Spectral Density Plots for both buoys. The significant wave height column should be read in feet (ft) instead of meters (m). It becomes obvious when reading the article but could be misleading otherwise.

Apology to JTWC

In the last several issues I have made some comments about the Joint Typhoon Warning Center being understaffed. They are not. I may also have given the impression that we were not receiving their data on time. First let me say that the Joint Typhoon Warning Center (JTWC) has played a significant role in any success that the Mariners Weather Log may have enjoyed, and has since 1959. Not once during that time have we ever had to wait for their invaluable reports. The information has always been timely, accurate and professional. JTWC is a first class organization by any standard. We were fortunate to obtain some track data prior to the end of the season and this "extraordinary" information enabled us to publish near real-time tropical cyclone tracks. Sometimes it is easy to take your friends for granted. I apologize.

—Editor

Great Lakes News

The Great Lakes Weather Marine Enhancement Program is now in operation. This is a cooperative effort between NOAA's National Weather Service and National Ocean Service to ensure better coordination of warnings and forecasts, ensure timely forecast updates, improve overall communication with the marine community and develop new marine forecast tools. The focus is at the Weather Forecast Service Office (WSFO) at Cleveland, OH. For any questions on the program or a newsletter call (216) 267-0070.

Under the enhancement program, responsibilities for the various American Great Lakes marine products are divided between several offices. Future issues will carry more information on this important program.

Historical Society of Michigan

The lighthouse drawing on the inside cover is one of a series published by the Historical Society of Michigan. A different series is featured each year on a calendar. A portfolio of lighthouse prints is offered to those joining the Society. For more information please write:

Historical Society of Michigan
2117 Washtenaw Av.
Ann Arbor, MI 48104

Wilhelmenia (Willie) Bowe

July 10, 1931 – December 15, 1987

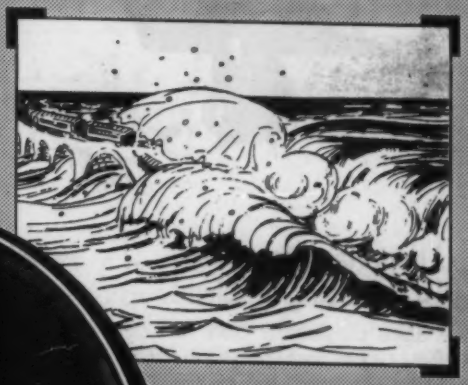
We recently lost a key member of the Mariners Weather Log staff. By title Mrs. Wilhelmenia McDougald Bowe was our Scientific Illustrator. But she was much more than that. It was Willie's artistic abilities that were mainly responsible for the new look of the Mariners Weather Log. In addition she was the heart and soul of our office. Her dedication, in spite of her illness was an inspiration to us all.

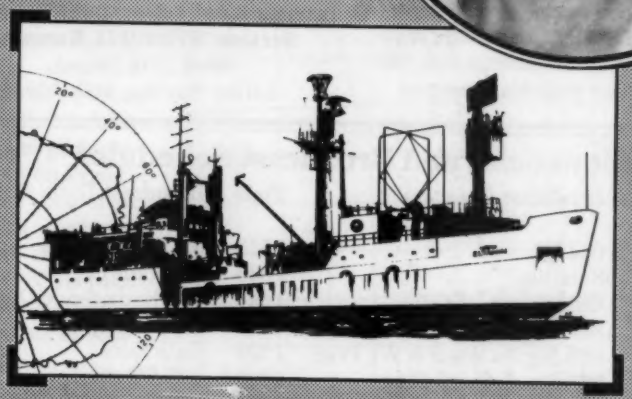
Willie was a native of Petersburg, VA, but a 30-year resident of the Washington Metropolitan area. She graduated from Peabody High in 1949 and Virginia State College in 1953. Willie worked for the National Oceanographic Data Center for 30 years and was involved with the Log for the past 16 years. At her funeral service her family dedicated the following appropriate passage:

Like a ship that's left its mooring
And sails bravely out to sea,
So someone Dear has sailed away
In calm serenity;
But there's promise of greater joy
Than earth could have in store
For God has planned a richer life
Beyond the Unseen Shore.

We are including a few of Willie's sketches as our tribute to a wonderful person.

Wilhelmenia Bowe





tips to the radio officer

--by Jullie L. Houston
National Weather Service
Silver Spring, Md.

Important Reminder! A Recurring Problem!

Some Ships transmitting OBS via USA CES INMARSAT are neglecting to disconnect the transmitter after sending their observations. This is causing a substantial cost to the National Weather Service (NWS). The NWS limit for an observation is not to exceed two minutes. For example, a ship failed to disconnect its sending equipment after completing the message leaving the transmitter open to 89.0 minutes costing a total of $404.95.

The NWS also reminds ships to use the correct format for Meteorological Surface OBS and Bathythermal OBS. For example:

(1) Bathys should start with **JJXX** and end with the **Call Sign**

(2) Met Surface OBS should begin with the **Ship's call sign** and end with **FIVE PERIODS.**

Interlacing Bathy and Ship Surfaces OBS format in one transmission results in loss of data within the system.

INMARSAT Weather Reports

INMARSAT equipped ships may transmit weather messanges using the following procedures after the message is composed off-line:

1. Select U.S. Coast Earth Station Identification Code 01.

2. Select routine priority.

3. Select duplex telex channel.

4. Initiate the call. Upon receipt of GA+ (Go Ahead).

5. Select dial code for meteorological reports, 41, followed by the end of selection signal, +.

6. Upon receipt of our answerback, NWS OBS MHTS, transmit the ships call sign and the weather message only. Do not send any other preamble. Example:

GA+
41+
NWS OBS MHTS
WLXX 29003 99131 70808 41998 60909
10250 2021/ 40110 52003 71611 85264 22234 00261 20201 31100 40803 .....

The five periods indicate the end of the message.

7. Terminate the call with manual disconnect.

Update

The publication "Selected Worldwide Marine Weather Broadcast" is being reformatted and updated, please send any schedule changes to the following address:

National Weather Service
International Telecommunications
Section W/OS0151 Room 419
8060 13th Street
Silver Spring, MD 20910

Northwood, UK Facsimile Frequencies and Broadcast Schedules

Time	Broadcast Data	Time	Broadcast Data	Time	Broadcast Data
0300	Schedule	0940	06Z Sfc Anal.	1525	& 1550 Specials
0315	00Z Sfc Anal.	1005	Satellite	1635	Schedule
0340	18Z Sig Su Wind & Wx Prog	1030	Gale Sum.	1645	12Z Radiosonde Obs
0600	00Z Sel. Radiosonde Obs.	1055	Sea Sfc Temp.	1710	Satellite
0630	00Z Sfc Anal.	1305	06Z Sig Su Wind & Wx Prog	1735	Gale Sum.
0655	Com. 0E & 2E Prog	1330	06Z Sea & Swell Prog	1800	12Z Sfc Anal.
0705	18Z Sig Su Wind & Wx Prog	1355	Satellite	1825	06Z Sig Su Wind&Wx
0800	Gale Sum.	1500	12Z Sfc Anal.	1950	06Z Sea&Swell Prog

Freq. & Times: 2813.85 KHZ; 1630-1730; 30 Sep-31 Mar 3436.85KHZ; 1930-0400; 1 Ap-29 Sep; 1530-0830;30 Sep-31 Mar 4247 .85KHZ; Continuous 6436.85 KHZ; Continuous 8494.85 KHZ; Continuous 12741.85KHZ Continuous; 1 Ap-29 Sep; 0730-1630; 30 Sep-31 Mar 16938.85 KHZ; 0400-1900; 1 Ap-29 Sep; 0830-1530 30 Sep-31 Mar ALL TIMES ARE UTC (GMT)

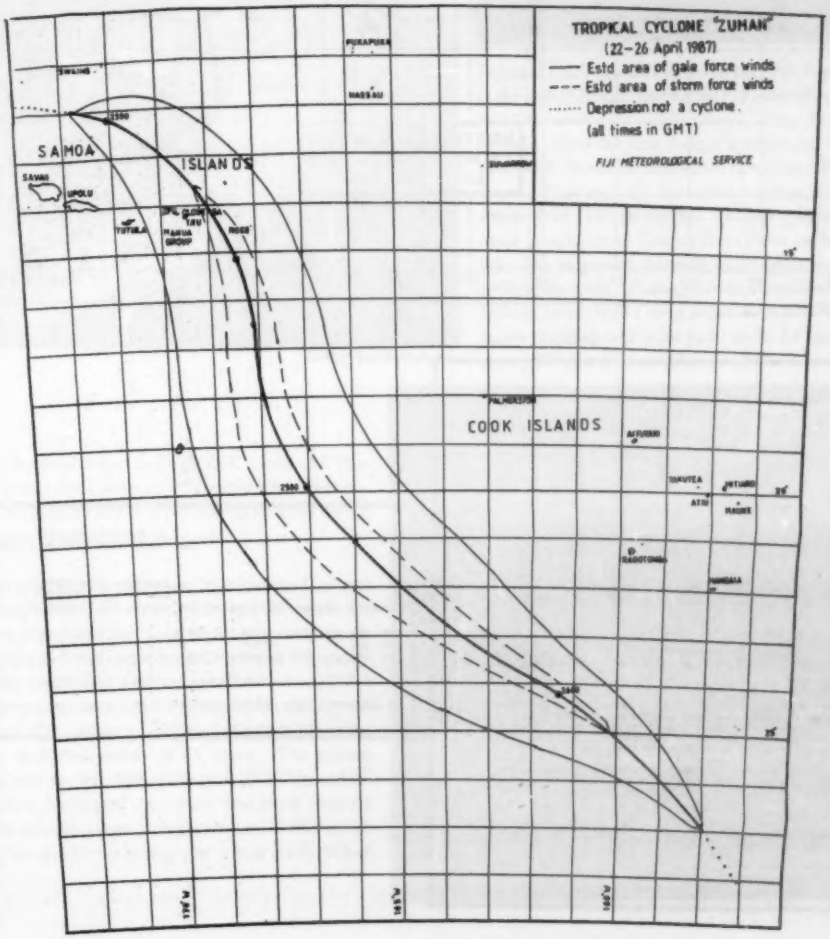
hurricane alley

hurricane alley

Tropical Cyclone Zuman
April 22- 26, 1987
Pradeep Kumar
Fiji Meteorological Service

Tropical cyclone Zuman developed about 100 miles to the north of Western Samoa. Initially it moved eastwards with only gale force winds around the centre, but later it attained storm intensity as it turned southward. The cyclone reached its peak intensity on 25th April when it was estimated to have sustained winds of 60 knots near the centre. It maintained this intensity for about 12 hours before it turned southeastward and weakened. It dissipated about 400 miles to the south of Rarotonga.

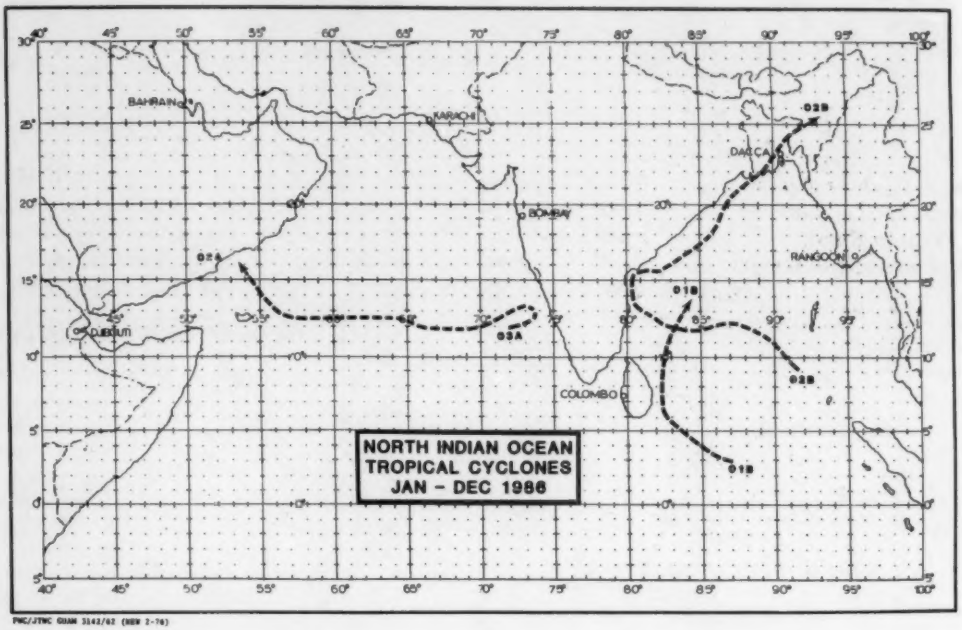
Tropical Cyclone Zuman intensified steadily as it drifted southward. However, the path it followed spared most of the islands from damaging or destructive winds. There were no reports of injuries or damages caused by sea, swell or floods. Whatever damages occurred can be classified as minor.



Western Samoa escaped with winds below gale force. No damage was reported but its main islands are likely to have received some heavy rainfall. Tutuila in American Samoa also escaped with just strong winds. Gusts up to 36 knots were reported from Tafuna. The islands of Ofu, Sili and Olosega suffered only minor damage. The most affected was Tau Island as sustained winds reached 40 knots and gusts 60 knots. damage was reported to homes, water and electricity supply, roads and vegetation. Reports received from Niue suggest that the area of gale force winds was very close to the island. Niue reported a gust of 47 knots on April 24th and further verification came from some ship reports close to the area. However there were no reports of any damage.

North Indian Ocean Tropical Cyclones, 1986
Based on material provided by the Joint Typhoon Warning Center, Guam

Tropical cyclone activity in the North Indian Ocean was slightly below normal. Three significant tropical cyclones, all of tropical storm intensity, developed as compared to the climatological mean of four. These systems occurred in the spring and fall transition seasons, which normally encompass the peak of the activity.



PMC/JTWC GUAM 3142/82 (REV 2-76)

FREQUENCY OF NORTH INDIAN OCEAN TROPICAL CYCLONES

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1971*	-	-	-	-	-	0	0	0	0	1	1	0	2
1972*	0	0	0	1	0	0	0	0	2	0	1	0	4
1973*	0	0	0	0	0	0	0	0	0	0	2	1	3
1974*	0	0	0	0	0	0	0	0	0	0	1	0	1
1975	1	0	0	0	2	0	0	0	0	1	2	0	6
1976	0	0	0	1	0	1	0	0	1	1	0	1	5
1977	0	0	0	0	1	0	0	0	0	1	2	0	3
1978	0	0	0	0	1	0	0	0	0	1	2	0	4
1979	0	0	0	0	1	1	0	0	2	1	2	0	7
1980	0	0	0	0	0	0	0	0	0	0	1	1	2
1981	0	0	0	0	0	0	0	0	0	1	1	1	3
1982	0	0	0	0	1	1	0	0	0	2	1	0	5
1983	0	0	0	0	0	0	0	1	0	1	1	0	3
1984	0	0	0	0	1	0	0	0	0	1	2	0	4
1985	0	0	0	0	0	0	0	0	0	2	1	1	4
1986	1	0	0	0	0	0	0	0	0	0	2	0	3
(1975-1986) AVERAGE	0.2	0.0	0.0	0.1	0.6	0.3	0.0	0.1	0.3	1.0	1.4	0.3	4.4
CASES	2	0	0	1	9	4	0	1	3	12	17	4	53

* JTWC WARNING RESPONSIBILITY BEGAN ON 8 JUN 71 FOR THE BAY OF BENGAL, EAST OF 90 DEGREES EAST LONGITUDE, AS DIRECTED BY CINCPAC, JTWC ISSUED WARNINGS ONLY FOR THOSE TROPICAL CYCLONES THAT DEVELOPED OR TRACKED THROUGH THAT PORTION OF THE BAY OF BENGAL. COMMENCING WITH THE 1975 TROPICAL CYCLONE SEASON, JTWC'S AREA OF RESPONSIBILITY WAS EXTENDED WESTWARD TO INCLUDE THE WESTERN PORTION OF THE BAY OF BENGAL AND THE ENTIRE ARABIAN SEA.

FORMATION ALERTS: 3 OF 9 FORMATION ALERTS DEVELOPED INTO SIGNIFICANT TROPICAL CYCLONES. TROPICAL CYCLONE FORMATION ALERTS WERE ISSUED FOR ALL OF THE SIGNIFICANT TROPICAL CYCLONES THAT DEVELOPED IN 1986.

WARNINGS: NUMBER OF CALENDAR WARNING DAYS: 8

NUMBER OF CALENDAR WARNING DAYS WITH TWO TROPICAL CYCLONES: 1

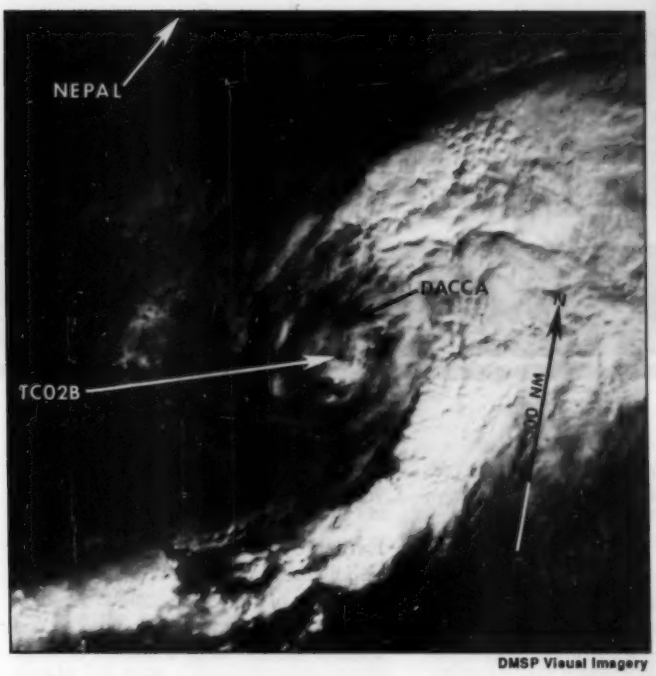
NUMBER OF CALENDAR WARNING DAYS WITH THREE TROPICAL CYCLONES: 0

NORTH INDIAN OCEAN
1986 SIGNIFICANT TROPICAL CYCLONES

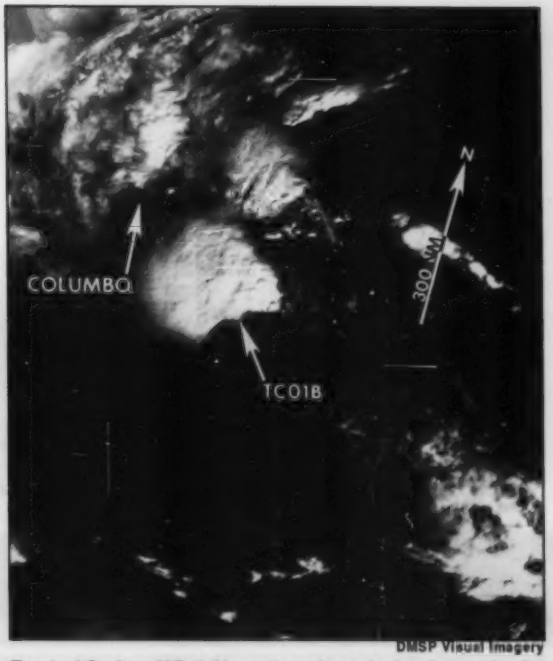
TROPICAL CYCLONE	PERIOD OF WARNING	CALENDAR DAYS OF WARNING	NUMBER OF WARNINGS ISSUED	MAXIMUM SURFACE WINDS-KT (M/S)	ESTIMATED MSLP - MB
TC 01B	07 JAN - 11 JAN	5	17	45 (23)	991
TC 02B	09 NOV	1	2	50 (26)	989
TC 03A	09 NOV - 11 NOV	3	9	45 (23)	990
	1986 TOTALS:	8 *	28		

* OVERLAPPING DAYS INCLUDED ONLY ONCE IN SUM.

North Indian Ocean Tropical Cyclones January—December, 1986



DMSP Visual Imagery

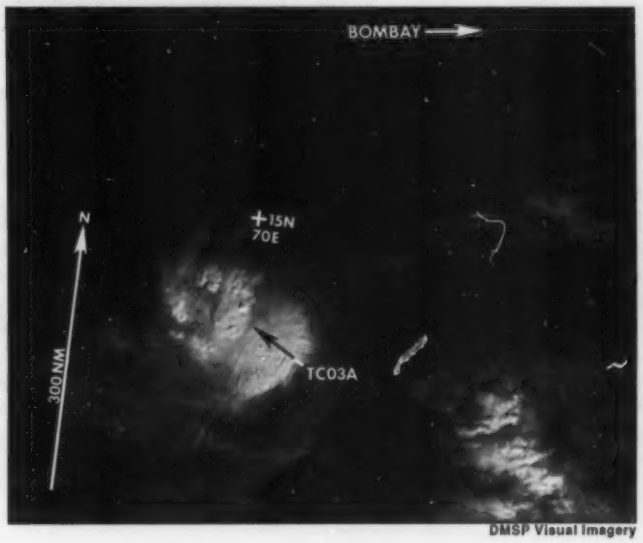


DMSP Visual Imagery

Tropical Cyclone 02B (left) was the only tropical cyclone to develop in the Bay of Bengal during the fall transition season. It began on the 3d of November as a disturbance, some 60 mi west of the Nicobar Islands. Over the next 3 days it continued to intensify as it moved westward. The disturbance then curved northward skirting the Indian coast. Post analysis indicated tropical storm intensity had been attained at 1200 on the 8th. TC 02B continued northeastward and made landfall at the Ganges River Delta in Bangladesh at 0000 on the 9th. The maximum intensity of 50 knots was reached just prior to striking the coast. Damage to the Bangladesh coast was substantial. Officials reported 11 dead and at least 50 others missing as a result of heavy flooding and wind gusts up to 65 knots. The satellite image shows TC 02B 3 hours after landfall.

The partially exposed low-level center of Tropical Cyclone 01B (top right) was located southeast of Sri Lanka at 0404 on the 8th of January. The system was being sheared by upper-level flow associated with a Southern Hemishpere hurricane (04S) to the south.

Tropical Cyclone 03A (right) was the only significant tropical cyclone to develop in the Arabian Sea in 1986. It was first spotted on the 1st of November. However, shear over the disturbance supressed development by separating the low-level circulation center and the upper-level anticyclone. and the system was weakening. However on the 8th of November redevelopment occurred. At 0532 on the 8th the Dvorak intensity analysis, of satellite imagery, indicated winds of 35 knots. Twelve hours later it indicated winds of 45 knots. The system was, once again, short-lived and by 1200 on the 11th, JTWC issued the final warning. The system dissipated over water and there were no reports of damage. The satellite photo at right shows TC 03A in the Arabian Sea 1 hour before the first warning was issued on the 9th of November at 0512.



DMSP Visual Imagery

MARINE WEATHER REVIEW

July 1987— Climatic changes were quite subtle for this month. In other words it was nearly normal, with the Azores-Bermuda High exerting a little more influence over Great Britain and the Norwegian Sea and a little less over the western North Atlantic(fig 1). The 700 mb level, which influences storm movement, showed an east northeastward flow across the northern North Atlantic and the storm tracks tended to follow this pattern.

On this date— July 4, 1776 — Thomas Jefferson paid for his first thermometer. Oh yes, he also signed the Declaration of Independence. According to his weather report the first Independence Day was cloudy and 76°F at 2 pm.

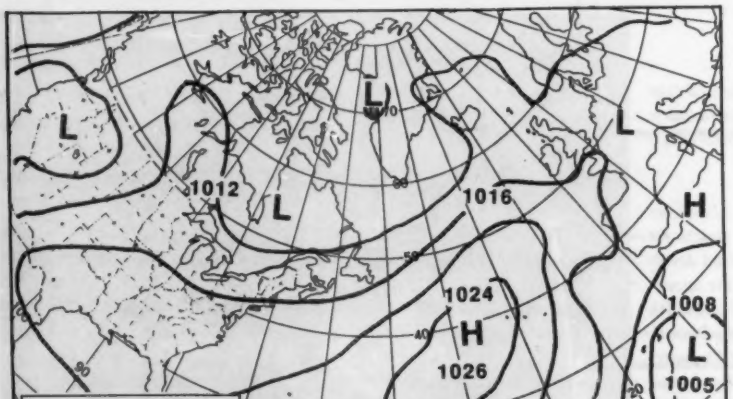


Figure 1 — Departures from normal were subtle in July.

Extratropical Cyclones— The Azores - Bermuda High kept most of the storm activity west of 35°W especially to the south of 55°N. Popular tracks ran just east and south of Iceland while a number of weak lows appeared between Bermuda and the Grand Banks.

Late on the 14th a cold front trailing out of a Low over central Quebec triggered a violent thunderstorm with torrential rains in Montreal. It left more than 100,000 residents without electricity and flooded the area with up to 15 ft of water, leaving at least one person dead. In all, 4.1 in of rain fell in 5 hr. The force of the water pressure blew manhole covers into the air and caused toilets to explode. Firefighters were called to rescue motorists stranded on expressways where torrents of water up to 15 ft deep submerged cars or washed them away.

❶ This Low originated near Saskatoon, Saskatchewan. It developed as it moved east southeastward across the northern Great Lakes on the 2d and 3d. The VCTV

The Weather Logs combined with the cyclone tracks, U.S. Ocean Buoy Climatological Data, gale and wave tables and ocean pressure patterns provide a definitive report on the primary storms that affect the North Atlantic and North Pacific Oceans. The Monster of the Month is a title given to an extratropical storm that may have been particularly hazardous to shipping. All storms are dangerous! Unless otherwise stated, winds are sustained and time is GMT.

North Atlantic Weather Log

July, August and September

on Lake Erie ran into 60-kn northwesterlies on the 3d. By the 5th the 1008-mb Low was off Nova Scotia and heading eastward. The following day the storm began to have an effect on North Atlantic shipping as it inten-sified and turned toward the northeast. At 0000 on the 7th the ***Kapitan Sviridov*** (37°N, 50°W) encountered 43-kn northerlies in 7-ft seas. The following day the VSBC reported 40-kn winds in 13-ft seas near 47°N, 48°W. The 999-mb Low continued northeastward until the 9th, when, nearing the 50th parallel, it started to fill and head eastward. The weakening system maintained its identity until the 11th as it passed over the Orkney Islands and into the North Sea.

● The origin of one of these systems can be traced back to the eastern North Pacific on the 3d. After moving ashore over British Columbia it made its way across the Canadian Provinces. On the 7th and 8th the Low crossed Hudson Bay and by the 10th it was over the Labrador Sea with a 992-mb pressure. At 0000 on the 9th the ***Kosmonavt Garagrin***, some 350 mi southwest of the center, encountered gales out of the northwest. By the 10th the center became part of a complex system, which organized on the 11th into a single center near 58°N, 37°W. Winds associated with the system were in the 20-to 30-kn range and seas were running 7 to 10 ft. By the 14th the central pressure had dropped to 988 mb. The system had stalled and was butting up against a 1023-mb High to the east. This created a tight pressure gradient across the British Isles and over the North Sea. On the 15th at 0000 the FVDX hit 66-kn northerlies near 58°N, 8°W. To the rear of the storm the ***Beskytteren***, near 59°N, 43°W, reported 58-kn westerlies. On the 16th along the frontal system of this stalled Low, another storm developed near St. Georges Channel. This 992-mb Low swept into northern France before moving through Belgium and the Netherlands and into the North Sea on the 17th. Eventually it completed a counterclockwise loop over England and moved into Germany on the 20th. This storm tightened the gradient even more and reports of 40-to 50- kn winds were common on the 16th and 17th. At 1800 on the 16th the ***Atlant*** was belted by 52-kn northerlies just north of the Shetland Islands. The following day a raft of reports came from the northern part of the North Sea as vessels encountered 40- to-50-kn winds in 8-to 12-ft seas. Among the vessels reporting were the ***Iolair, Dzehems Bankovich***, and the ***Benvenue.***

Tropical Cyclones — July in the North Atlantic is usually a quiet month. This year was no exception. Since 1931 there have been just 43 tropical cyclones, of which 20 have become hurricanes, in July.

Casualties — The cargo carrier ***North Star*** and the ferry ***Cape Henlopen*** collided in fog off the North Fork of Long Island, New York at 0923 on the 9th of July. Some 20 people were injured. The injured were taken to Eastern Long Island Hospital where all but one were expected to be released after treatment for broken bones and minor injuries. A hole 4 ft by 30 ft was found in the ***North Star*** above the waterline. The motor vessel ***Balsa 6*** was discharging cargo at Georgetown, Guyana. Her mooing lines broke at 1012 on the 11th, due to strong currents. She made contact with the ***Windglow***, which sustained minor damage.

August 1987 — The Azores- Bermuda High which dominates the North Atlantic at this time of the year, (fig 2), showed a -5mb anomaly and the normally weak Icelandic Low was 6 mb stronger than normal. This combined with northeastward to east northeastward orientation of the steering currents at 700 mb, resulted in a flurry of minor storm activity over the shipping lanes.

On this date — August 26, 1949— A hurricane made landfall at Delray Beach, FL. Winds reached 133 kn at Jupiter Lighthouse before the anemometer failed. The hurricane caused $45 million damage in Florida.

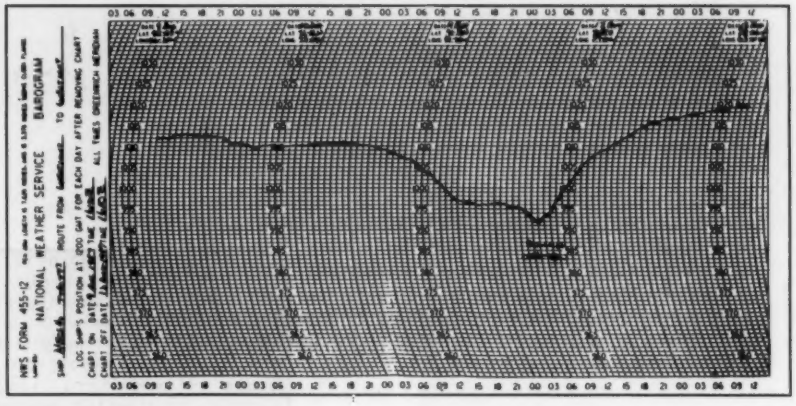


Figure 3.—The barogram from the Neosho TAO-143. Minimum was 993 mb.

Extratropical Cyclones — On the night of the 21st thunderstorms, associated with a frontal system over France extending from a Low over the Norwegian Sea, left many parts of England and Wales under water. Homes in Kent, Sussex and Hampshire were damaged by rain and lightning. Flash floods also hit North Yorkshire. A few days later on the 24th the same mechanism triggered heavy rains in Europe causing at least seven deaths. Three deaths were reported in Belgium, three in Switzerland and one in Italy. Paris had its heaviest deluge in more than a century, when 3.8 in of rain fell in 24 hr. Strong winds and rains demolished a campsite at Laroque-des-Alberes overturning 15 caravans and mobile homes. Landslides cut off two valleys in Austria's Tyrol Province. Some of the heaviest rainfall this century also left parts of northern Italy, France, Belgium and Switzerland struggling with floods.

❶ This system developed as a frontal wave on the 8th over Iowa. By the 10th it was off the New Jersey coast but still not much of a Low. The storm continued as one of four waves along a front that stretched across the entire Atlantic from the Carolinas to France. By the 12th, near 43°N, 55°W, the Low became the dominant system. The ***Neosho TAO-143*** provided a look at the system via a barogram (fig 3). The ***TFL Enterprise*** (42°N, 61°W) and the ***Sedco 710*** (44.°N, 54°W) at 0000 on the 12th encountered winds of about 45 kn, with seas running from 10 to 15 ft. By the 13th central pressure had fallen to 981 mb and several ships within 150 mi south of the center were reporting 35-to 40-kn winds in 15-to 18- ft swells. The ***Sedco 710,*** 300 mi to the west, encountered 50-kn northeasterlies in 13-ft seas. On the 14th gale reports were common throughout the southwest quadrant. The ***Professor Khromov***, for example, hit 40-kn west southwesterlies some 480 mi to the south of the center. The storm continued to cause problems through the 16th as it swung northward.

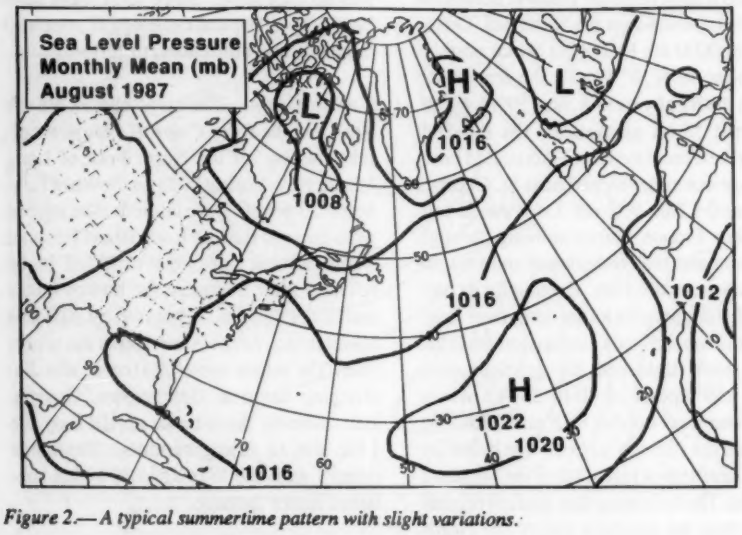


Figure 2.—A typical summertime pattern with slight variations.

❷ On the 14th a small Low developed on the North Slope along the Alaska-Canada border. Its trans Canadian journey took it southeastward into Alberta then northeastward over the Hudson Bay by the 18th. It then turned a counterclockwise loop and swung southeastward into Quebec, only to turn on the 23d and head toward the northeast. The first indication that this system was going to be a problem to shipping came on the 22d, at 1200, when the ***Narwhal*** and the ***Lakeshell*** along the southeast shore of Hudson Bay encountered 40-to 45-kn winds; the ***Lakeshell*** had a 983-mb pressure. On the 23d the ***Eastern Shell***, just south of the Ottawa Is, in Hudson Bay, was belted with 62-kn northeasterlies. Meanwhile on northern Lake Superior the ***Slidell Louisiana*** reported 48-kn northwesterlies in 7-ft seas. At 1200 the ***Narwhal's*** winds hit 50 kn from the north, and 6 hr later the ***Lakeshell*** reported winds of 40 kn. At the same time the CG25

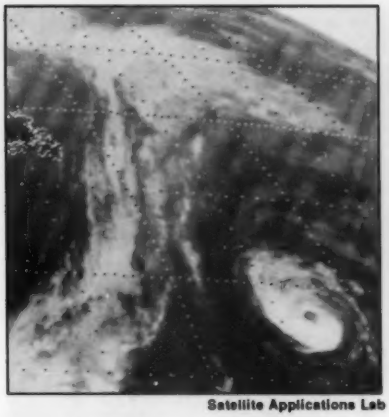


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Figure 4.— Arlene at 1401 on the 22d.

in Georgian Bay ran into 50-kn southwesterlies. By the 24th the storm was over Labrador but the vessels in Hudson Bay were still indicating 40-kn winds. Late in the day the ***Wilfred Templeman*** in the Hudson St measured 45-kn northeast winds. Godthaab Greenland, at 1200 on the 25th, reported in with 35-kn southwesterlies northeast of the 992-mb center. The storm crossed the Labrador Sea on the 25th and 26th, then moved across Greenland the following day. The trek overland weakened the storm and it moved into the Denmark St on the 28th with a 1000-mb pressure.

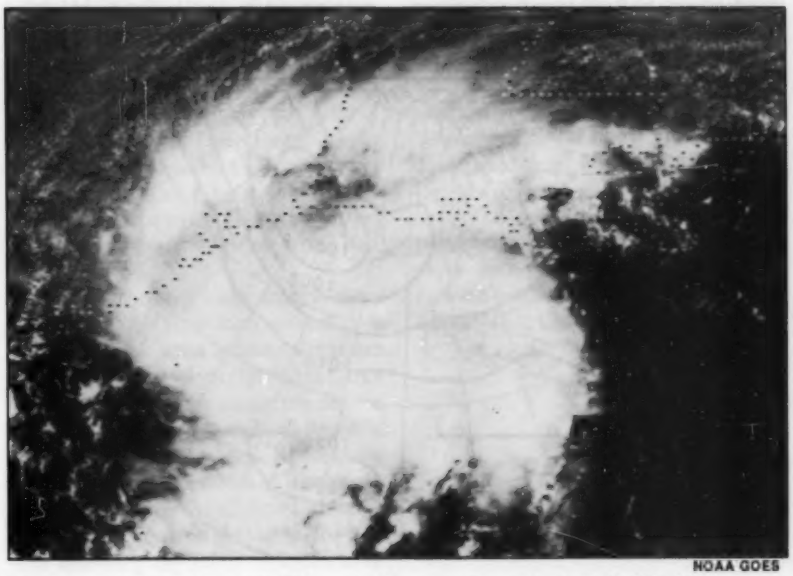
Tropical Cyclones — The first named storm had its beginnings in the western end of a decaying frontal zone near Wilmington, NC, on the 8th. For the next several days the center of low pressure tracked southward then southwestward toward the northern Bahamas on a gradual anticyclonically curving path. It became a tropical depression on the 10th and, moving northeastward, tropical storm Arlene the following day. It tracked about 50 mi north of Bermuda, where winds at the Naval Air Station reached 30 kn with gusts to 43 kn. The VJNV, just 36 mi north of the center at 1800 on the 13th, reported 65-kn winds with a 1002-mb pressure in a local area of convection. Six hr later she reported 45-kn winds. Winds of 40 kn were reported by the ***Izmaylovo*** and the ***Besstrashnyy*** on the 14th and 15th. On the 20th the storm stalled for about 24 hr. Arlene reached hurricane intensity at 0600 on the 22d (fig 4). By this time Arlene was racing northward and then northeastward and began interacting with a frontal zone. This, together with the colder waters, caused the system to become extratropical by 0000 on the 24th. The remnants of Arlene could be tracked around the northern periphery of a High and then southeastward along its eastern edge using ship reports. The system finally moved into Gulf of Cadiz and dissipated in south central Spain early on the 28th.

An unnamed tropical storm developed from a tropical wave that moved off the coast of Africa in late July. The wave moved across the Atlantic and helped spawn a tropical depression in the Gulf of Mexico on the 9th. During the day isolated reports from oil rigs indicated there were some local sustained winds reaching gale force. The oil rig reports were very important in determining that the system was a tropical storm as it moved northward onto the eastern Texas coast, between Galveston and Beaumont, on the 10th (fig 5).

The storm, which had maximum winds of about 40 kn, weakened to a depression near the Louisiana border as it curved eastward. On the 15th it skirted southeastward briefly and emerged into the Gulf of Mexico around Cape San Blas. It re-entered the Florida Panhandle on the 16th near St. Marks and lost its identity in eastern Georgia on the 17th.

Tropical storm Bret was spawned by a well-organized tropical disturbance, which moved off the northwest African coast on the 17th and became a tropical depression the following day. Later on the 18th the ***Columbus Canterrury*** reported 35-kn winds with a 1004.5-mb pressure just west of the Cape Verde Is. This was the primary basis for upgrading the depression to tropical storm Bret. Bret moved westward at 15 to 20 kn through the 20th. It reached maximum strength on the 20th when winds were estimated at 45 kn with a low pressure of 1000 mb. From the 21st through the 23d Bret slowed to 10 to 15 kn and gradually assumed a more northwesterly course. Upper level shearing caused it to weaken and, on the 22d, it was dropped back to depression intensity. By the 24th it was a tropical wave.

Casualties — On the 4th the ***Merkur Bay*** sailing from Tampico collided with a river ferry, apparently losing control due to strong river currents. The first stage of the Ekofisk North Sea platform jacking-up operation was delayed due to severe weather conditions early in the month. The weather was also holding up the installation of the giant Gullfaks "B" oil production platform. Winds were reaching 55 kn.



NOAA GOES

Figure 5.— An unamed storm at 1701, on the 9th, roams the northwest Gulf of Mexico.

September, 1987— While the climatic chart (fig 6) shows that the Azores-Bermuda High is still in control, the Icelandic Low is starting to make its presence felt. This year the Low was about 8 mb deeper than normal and centered just south of Iceland with negative anomalies extending towards England and south into the eastern North Atlantic. Otherwise things looked normal. The steering currents at 700 mb were basically zonal, from west to east, from North America to about 30°W. To the east they curved cyclonically toward the east northeast. In this idealized picture a storm starting over Nova Scotia would end up in the English Channel.

On this date — September 5, 1950— Hurricane Easy produced the greatest 24 hr rainfall in U.S. weather records. The hurricane deluged Yankeetown, located on the upper west coast of Florida, with 38.7 in of rain.

Extratropical Cyclones — The tracks conformed quite well to the steering currents. Quite a few storms contributed to the Icelandic Low by moving just south of Iceland on an east northeastward path into the Norwegian Sea. Toward the end of the month over the eastern Great Lakes a cold front triggered some strong thunderstorms. The front extended from central Ohio to the central Gulf of Mexico coast. The strongest thunderstorms hit Buffalo on the afternoon of the 29th and produced gusts to 54 kn.

❶ The month started out with a bang, thanks to a storm that was actually spawned toward the end of August. From an incipient wave on the 31st, near 46°N, 46°W, this system quickly got it together and was generating near gale winds around a 984-mb center at 1200 on the 1st. Twelve hours later the ***OSV C*** radioed in 52-kn north northwesterlies near 53°N, 36°W in 33-ft seas. By 2100 her winds were up to 56 kn with a 994 mb pressure. This intensity was supported by the ***Ernst Krenkel*** and the ***Ivan Ayvazovskiy***. The ***Ivan Ayvazovskiy***, at 1200 near 50°N, 30°W, encountered 52-kn winds in 28-ft seas. Fall was under way in the North Atlantic! During the 2d central pressure had dropped to 970 mb as the system swung northward and headed for Iceland to make its contribution to the Icelandic Low. The 3d brought a flurry of gale and storm reports from vessels, which included the ***Sigrour Palmason, Bjarni Saemundsson, Eyrarfoss, Cicero, Clarence, Nikki Ittuk,*** and the ***Ernst Telman***. All these valuable reports helped determine the intensity of this viscous storm. The ***Clarence*** had the highest wind report of 60 kn at 0600 near 53°N, 25°W. The storm circled Iceland from the 5th through the 7th and gales extended into the Norwegian and North Seas. At 1800 on the 4th the ***Hvassafell*** was burned by 60-kn northeasterlies and reported a 982-mb pressure near 66°N, 24°W. The ***Nikki Ittuk*** was nailed by 21-ft seas at 0300 on the 5th. By the 7th central pressure was up to 996 mb as the storm scooted eastward through the Norwegian Sea.

❷ Ex tropical storm Cindy turned into a potent extratropical storm. The transformation was completed on the 10th. On the 14th it merged with a system whose beginnings can be traced backed to a Low that developed as a wave along a front over Lake Superior on the 6th. It moved through the Gulf of St. Lawrence on the 8th but was nothing to write home about until the merger. On the 12th the two had united into a potent 970-mb storm near 59°N, 25°W. Its influence spread southeastward to the Continent and eastward to the Norwegian Sea. Reports of 45 to 55 kn were common and sea heights ranged from 20 to 30 ft. Among the reporting vessels were the ***Peggy Dow, Fjallfoss*** and the ***Arnarfell***. The ***Peggy Dow*** , near 57°N, 19°W at 1200, encountered 55-kn winds with a 977-mb pressure in 20-ft seas, with a slope of about 1/20. Even the OV24 in the Skagerrak was feeling the brunt of 40-kn winds by 0000 on the 13th. By this time the ***Peggy Dow*** was riding 30-ft seas. Winds of 40 to 50 kn continued throughout the day as storm swung westward then turned eastward on the 14th. It weakened then reintensified briefly on the 17th as it made its way toward Norway.

❸ This storm first showed up in the Labrador Sea on the 16th. Moving in on arc toward the northeast it developed slowly. In fact, on the 19th, its central pressure was only 994 mb compared to 998 mb on the 16th. Then something dramatic occurred. The storm slowed, turned a counterclockwise loop and deepened rapidly. By 1200 on the 20th central pressure dropped to 976 mb, to 972 mb 24 hr later and to 960 mb by 1200 on the 22d. Reports from vessels in the vicinity mirrored this intensification. On the 20th wind observations were running 40 to 45 kn with seas of 15 to 20 ft. At 0000 on the 21st the ***Thuleland*** (57°N, 29°W) encountered 54-kn westerlies in 16-ft seas with a slope of 1/20 and a pressure of 985.5 mb.

Six hr later the ***Neftegorsk*** (56°N, 28°W) reported a 983-mb pressure with 47-kn winds in 23-ft seas. The ***Meerkatze*** was blasted by 60-kn winds in 23-ft seas at 0900. The pounding continued through the

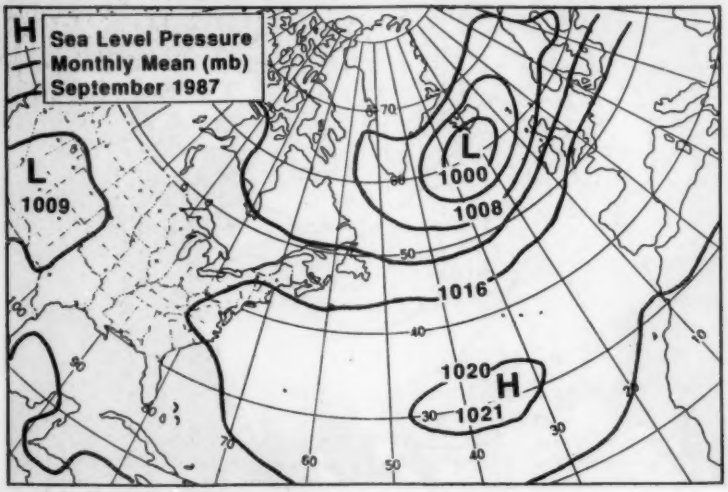


Figure 6.— The intensification of the Icelandic Low signals the beginning of Autumn.

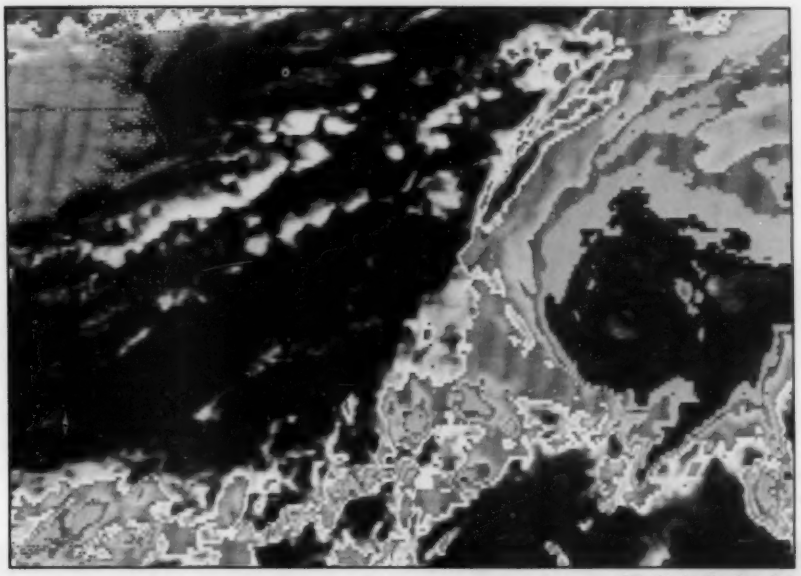


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Figure 7.—An enhanced view of Emily, at 0931 on the 25th, shortly before crossing Bermuda.

22d with wind reports ranging from 40 to 65 kn. On the 23d the 980-mb system was headed east northeastward toward Norway. Winds of 40 kn were being reported through the 24th.

Tropical Cyclones — Three tropical cyclones developed into two tropical storms and one hurricane during the month.

Cindy had its beginnings as an area of disturbed weather over Africa. The disturbance moved off the coast on the 1st and changed little during the next few days. It became better organized on the 4th and reached depression stage the following day. The westward moving depression was upgraded to a tropical storm on the 7th near 25°N, 39°W. Cindy attained maximum intensity on the 8th when winds climbed to 45 kn around a 1000-mb center. By this time the system was recurving northward. Strong shearing aloft started to weaken Cindy late in the day.. As the center passed just northwest of the Azores on the 10th it generated 30-kn winds on the northwest island of Flores. By the afternoon Cindy became extratropical and had a much more exciting life, starting on the 11th.

Dennis was detected as low level circulation near the African coast on the 8th. Moving west northwestward at about 10 kn, it reached tropical storm strength on the 10th and a peak the following day when winds climbed to 45-kn around at 1000-mb center. On the 18th an Air Force reconnaissance plane discovered, while investigating a depression northeast of Antiqua, that Dennis had weakened and it was downgraded to a depression. On the 20th it merged with an extratropical system over the central north Atlantic.

Emily was the first hurricane in the Caribbean Sea since Katrina in 1981. At no other time in recent history has there been such an extended absence of hurricanes in this area. Although Emily was a small hurricane it will be remembered for its impact on the Dominican Republic and sudden intensification before hitting Bermuda with 75-kn winds gusting to 101 kn. It was the strongest hurricane to hit Bermuda in 39 yr.

Emily reached hurricane strength about 175 mi south of Puerto Rico on the 22d. It attained a peak when minimum pressure fell to 958 mb and winds climbed to 110 kn about 9 hr before the center crossed the southwest coast of the Dominican Republic at about 0300 on the 23d. It weakened rapidly over the mountains of Hispaniola. Emily moved over the southeast Bahamas as a tropical storm on the late on the 23d. The following day Emily appeared to be into a frontal system to the northwest and losing its tropical characteristics. However, on the 25th, a reconnaissance aircraft found that it was accelerating and deepening rapidly and Emily once again became a hurricane. The center passed directly over Bermuda at 1145 on the 25th where a minimum pressure of 973.6 mb was recorded (fig 7). During the 12 hr period, 0000 to 1200 on the 25th, minimum pressure fell at an average rate of 2 mb/hr. Emily continued to accelerate after passing over Bermuda with forward speeds reaching 55 kn as the system crossed 40°N. It gradually weakened over the cold waters of the North Atlantic on the 26th.

Damage was considerable to the banana industry on St. Vincent and farms were seriously affected in the Dominican Republic where damage was estimated at $35 million; three people died and six were injured. Damage in Bermuda was also estimated near $35 million. In addition thousands of migrating land birds were caught in the hurricane and found refuge on Bermuda. Included were more than 10 thousand Bobolinks from North America on their way south as well as thousands of Connecticut Warblers.

Casualties — In Emily the cruise ship ***Atlantic*** at Bermuda, carrying 850 passengers, broke free of her lines and floated across the harbor. There was some damage to the stern due to banging into the dock. Also in Emily the ***United Knowledge*** ran aground in Indian Bay, St. Vincent; she was reported to have had problems in the poor visibility. On the 12th the Yugoslavian ***Rudar Bascovic***, downbound from Chicago to Toledo, in fog, hit a new seawall just below the bridge on the U.S. side, ripping out about 180 ft of piling. On the 23d the ***Canadian Enterprise*** encountered dense fog and ran aground just below buoy Delta 68 in the Amherstburg Channel, Ont.

Marine Weather Review (cont'd)

July— Normally a subtropical high dominates the entire Pacific in July, with a 1025-mb center near 40°N, 250°W. This time around (fig 1) the high was prominent but most influential over eastern waters. This is reflected in a huge area of negative 4-to 7-mb anomalies in the west. In the steering currents at 700 mb there were two troughs, one at 170°E and the other along the west coast of North America. Both dug deeper than normal so the storm track pattern was influenced, particularly north of 40°N. In general storms moved west to east to near the dateline and then a northeasterly trend was apparent.

On this date — July 16, 1946 — The temperature at Medford, OR soared to an all time high of 115°F to begin a 2–week heat wave. During the heat wave the mercury hit 100°F at Sexton Summit for the only time in 40 yr of record.

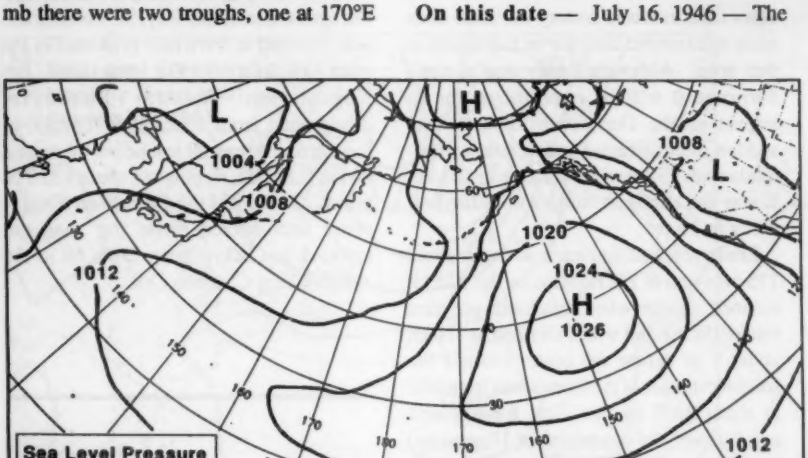

Figure 1.—The subtropical High dominates the eastern North Pacific.

Extratropical Cyclones — The subtropical high over the eastern North Pacific provided an effective shield for the Gulf of Alaska for a good portion of the month. In the west, China continued to suffer a wetter than normal rainy season, particularly in Sichuan Province, which had been in the grip of its longest drought in 40 yr. During the first 2 weeks of July downpours caused extensive flooding in Hubei Province, which resulted in 42 deaths. This brought to 552 the number of people killed by storms and floods since the beginning of the rainy season in May.

❶ This storm was first detected just east of Korea on the 11th. Central pressure dropped to 988 mb and remained there for several days as the system plowed east northeastward. Roughest weather was being experienced to the south of the storm center between a warm and cold front, where on the 12th and 13th winds were

North Pacific Weather Log
April, May and June

ranging from 20 to 30 kn and seas of 8 to 16 ft were being reported. Early on the 14th the ***Sirius*** and the ***President Grant*** both encountered 40-kn winds some 500 mi from the center. The ***President Grant*** in the northeast quadrant was estimating 21-ft seas on with a slope of about 1/7— very steep. By 0000 on the 15th the central pressure was down to 985 mb. Wind of 40 to 45 kn were encountered by the ***Lisboa II, President Grant, Korean Topaz*** and the ***Mobile Kestrel***. These winds continued into the 16th, but the system began to weaken during the day.

❷ An atmospheric wave along a front gave rise to this storm on the 20th, just east of Honshu. By the 22d winds of 20 to 25 kn were common within 100 mi of the center. The ***Novooulyanovsk*** (43°N, 159°E) reported a 58-kn north northwesterly at 0000 on the 23d; this seems to be a little high, but may just be a transmission error. At this time the storm was swinging northeastward and it was intensifying. A tight gradient between the 984–mb Low and a 1032-mb High to the east was causing a few problems to shipping. On the 25th at 0000 the ***Chikebu Maru*** (54°N, 170°W) encountered 58-kn southerlies. At the same time the following day the ***Century Highway No. 3*** hit 41-kn soutwesterlies in 12-ft swells some 700 mi east of the now weakening center.

Tropical Cyclones — A total of 10 tropical cyclones came to life over the North Pacific in July, six in the east and four in the west.

On the 4th tropical storm Beatriz developed from the fourth tropical depression of the season in the east. By this time the system was a near 14°N, 118°W. Beatriz moved west northwestward for the next several days. Winds reached 45 kn on the 5th and while the storm was becoming more distinct on satellite photos (fig 2), convection was decreasing and it was heading for cooler water. On the 6th the storm

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Figure 2.— Beatriz at 1145 on the 5th and to the right the beginning of Calvin.

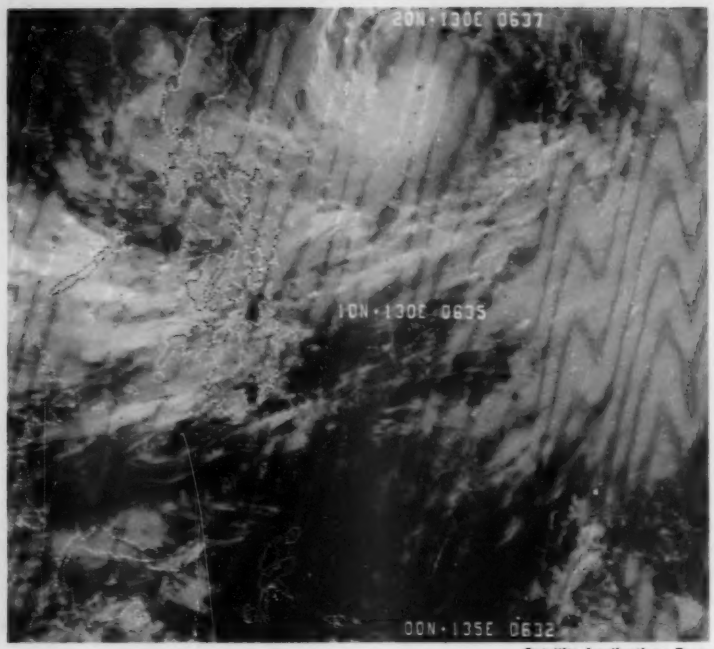

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Figure 3.—Thelma near its peak on the 11th.

dropped back to a tropical depression. Meanwhile tropical storm Calvin was upgraded from tropical depression No. 5, early on the 6th, near 13°N, 105°W. Calvin headed west northwestward at about 15 kn. Maximum winds reached 45 kn on the 7th and 55 kn the following day. By the 9th the westward moving storm began to weaken. Before the day was through it was downgraded to a tropical depression near 15°N, 119°W.

By this time typhoon Thelma in the west was already at tropical storm strength. By the 10th Thelma attained typhoon strength and was heading toward the Philippines. Before it reached the Islands it recurved toward the north, on the 12th. The following day the ***Ficus*** (22°N, 122°E) encountered 40-kn north northwesterlies. Near its center Thelma was generating 75-kn winds. This was down from the 120-kn maximum on the 11th and 12th (fig 3). Thelma continued northward through the East China Sea and across Korea. At 1200 on the 14th the ***Maritime Star*** (26°N, 122°E) hit a 41-kn northerly in 16-ft seas. On the 15th at 0600 the ELDU, 150 mi east of the storm, reported 62-kn southeasterlies while the ***Keifu Maru ran*** into 20-ft seas in 46-kn winds about 60 mi west of the center. Thelma left 117 people dead with another 214 missing as it ravaged the southern states of South Korea. Hardest hit was the area around the part of Busan.

While Thelma was moving through the Sea of Okhotsk as an extratropical storm, typhoon Vernon was making its way toward the Philippines. Vernon reached typhoon strength on the 19th. By this time it was recurving northward in a fashion similar to Thelma. Vernon was responsible for at least two deaths on Taiwan. It was turning extratropical as it blasted Korea with gales and torrential rains. On the 22d the Sochon area, about 110 mi south of Seoul, received 24.5 in of rain. This is the highest since records began in 1907. Across the ocean, tropical storm Dora had come to life south of Manzanillo on the 15th. It moved westward for several days. Maximum winds climbed to 50 kn on the 17th as it turned northwestward and began to move over cooler water north of the 20th parallel. There was a flurry of late month activity on both sides of the Pacific. Typhoons Wynne and Alex roamed the western waters while in the east Eugene, Fernanda and Greg all came to life.

Wynne was by far the most powerful. Maximum winds were estimated at 125 kn on the 26th as the storm was beginning to recurve near the 20th parallel. Wynne turned in time to miss a direct hit on Japan. Alex, however, a minimal typhoon, battered the central coastal province of Zhejiang, China late on the 27th. Some 69 people lost their lives and 200 were injured. In the eastern Pacific, hurricane Eugene was responsible for at least three deaths and left some 5,000 people homeless along Mexico's central Pacific coast. Hardest hit was the resort of Manzanillo. Crop damage in Colima and Michoacan alone was estimated at $142 million. Eugene had developed on the 23d, near 12°N, 131°W. Initially a tropical depression generating 25-kn winds, the system intensified rapidly. By 1500 on the 24th Eugene was a full-fledged hurricane, heading northward and within 180 mi of land. Winds increased to 85 kn near the center as it neared the coast on the 25th.

Fernanda was one of those westward moving tropical storms that made its way into the Central Pacific region. The storm developed on the 24th. By the 26th maximum sustained winds reached 55 kn as the center crossed into central waters west of 140°W. However, it did not intensify further and by the 28th, about 540 mi southeast of Hilo, Fernanda was downgraded to a tropical depression. Meanwhile hurricane Greg was being spawned far to the east. Greg reached hurricane strength late on the 31st near 19°N, 112°W. However by late on the lst Greg dropped back to tropical storm strength. Heading westward it was downgraded to depression intensity by late on the 2d.

Casualties — The major event this month was typhoon Thelma. The ships involved in minor collisions and mishaps are too numerous to list so the following is a shortened summary. Vessels that ran aground near Korea include the ***Aurora, Probo Hawk, Manhattan, Oriental Ace, Dona*** and ***Chance No. 73***. The tug ***Yeonan*** and barge ***Geobugee 24*** sank at Ulsan, while the ***Bornion Tiga*** went hard aground in the South China Sea. The ***Chun Yang*** was swept away by strong currents and sank off Pusan. Ships damaged by Thelma include the ***Warsak, Conti Bavaria, Haeng Bok No. 511***

and the drilling platform ***Doo Sung***. Collisions due to the storm involved the ***Safer*** and ***Concert Express, Amana and Mary Star***, and the ***Emanuel B.*** with the ***Morning Star***.

With no success the U.S. Coast Guard searched for survivors from the apparent sinking of a vessel 720 mi southeast of Honolulu. On the 27th a vessel reported her name as ***Mary Margaret*** and stated that there were 18 people onboard. Search efforts were hampered by the presence of tropical storm Fernanda. Some debris was sighted in the search area, which would seem to substantiate that a vessel might have sunk in the general vicinity.

August, 1987 — The outstanding climatic feature for the month was a +10-mb anomaly centered over Alaska with positive departures covering the eastern Bering Sea, Gulf of Alaska and northeastern North Pacific. This means that this region, which is usually on the fringes of the subtropical high was in the heart of it (fig 4). The result was good news for mariners in the form of decreased storm activity in these areas. Aloft, a ridge in the Gulf of Alaska and a trough over the Kamchatka Peninsula, at 700 mb, helped shape the steering currents. Over the main shipping routes Lows tended to move eastward to the dateline and then sharply toward the north or northeast.

On this date — August 4, 1959 — hurricane Dot, generating 140-kn winds, bore down on Hawaii. Passing close to South Point, Hawaii, Dot blasted the area with 75-kn winds, heavy seas and torrential rains. Unofficial reports of 90-kn winds were received. The hurricane unroofed houses, uprooted trees and knocked down power lines as it raked the entire island of Kauai.

Extratropical Cyclones — In general storm activity was sparse and confined to west of the dateline. Activity off Kamchatka is reflected in an intensification of a normally weak climatic low in that area.

❶ This storm came to life toward the end of last month over the Kuril Is. After intensifying briefly on the 30th it began to fill as it headed northeastward. However late on the 2d as it crossed 175°E near 57°N it began to reintensify. Ship reports indicated this strengthening. The ***Sea Lark*** (54°N, 179°W) at 0000 on the 3d reported 44-kn southwesterlies, and several other vessels encountered gale force winds. At 0600 on the 4th the ***Farnella*** hit 54-kn westerlies and the ***Alva Maersk*** reported a 45-kn blow in 13-ft seas. The ***Chelsfield***, 6 hr later, confirmed these reports when she ran into 45-kn winds in 12-ft swells near 52°N, 172°W. By 1200 on the 4th the central pressure had dropped to 984 mb as it moved northeastward through the Bering Sea. However it began to fill the following day as it moved past Nunivak Is and into Norton Sound.

❷ While the previous storm was dying over Alaska, this system was developing as an atmospheric wave along a front in the Sea of Japan. By the 6th it had developed its own circulation and was creating problems to shipping over the routes to and from Tokyo. At 0600 the ***Green Master*** (43°N, 153°E) was belted with 41-kn south southwesterlies in 8-ft seas. The ***Youlian Markhlevskii*** ran into 45-kn northerlies at 0000 on the 7th near 51°N, 144°E. By this time the 1000 mb Low was cruising northeastward. Off the Kamchatka Peninsula on the 8th the 990-mb Low was generating strong winds throughout its southern semicircle. The strongest winds came in from the ***Green Master*** with 54-kn west southwesterlies in 10-ft seas. This was supported by the ***Hiyoshi Maru*** with 50-kn northerlies. The ***Green Master*** continued to report strong winds (45 kn) on the 9th and 10th. The storm had slowed and turned southward for a short time. However by the 12th it was heading northward. It also began to fill.

❸ On the 25th near 35°N, 155°E, an innocuous looking wave was forming along a front. It moved eastward but developed slowly. On the 26th it began to swing toward the northeast and winds were running abut 25 kn. Swells of 10 to 15 ft were being encountered, probably from typhoon Dinah to the southwest. On the 27th some gale reports were coming in from the south. Swells continued to roll in from the southwest.

The USHT hit gales about 250 mi south of the center. The Low moved north northeastward for the next 2 days. On the 29th it deepened to 990 mb. On the 30th at 0600, near 51°N, 168°E, the ***Young Soldier*** was hit by 55-kn northwesterlies in 10-ft seas with a slope of 1/19. This was confirmed the following day by the ***Shushenskoye*** in the Zaliv Sellichova (northeast of the Sea Okhotsk), which reported 54-kn westerlies. The 986-mb Low was moving into the western Bering Sea as the month came to a close.

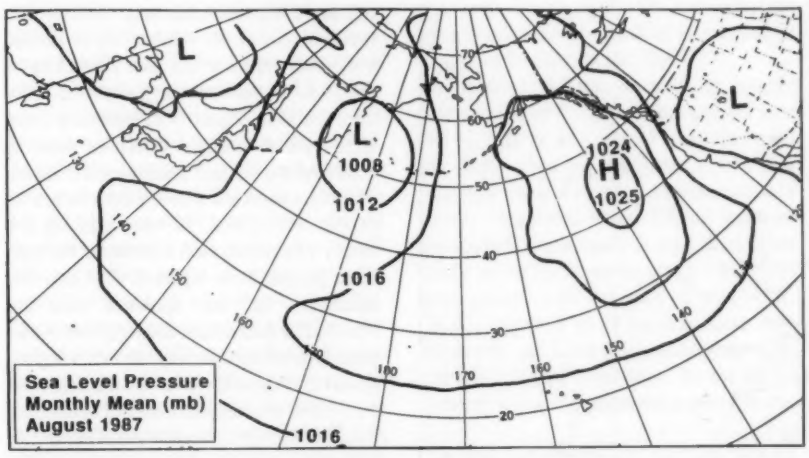

Figure 4.— The subtropical High dominates the eastern North Pacific.

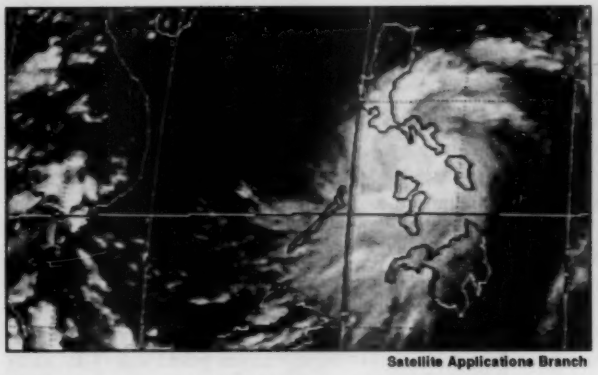

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Figure 5.— Betty rakes the Philippines at 0831 on the 12th (IR).

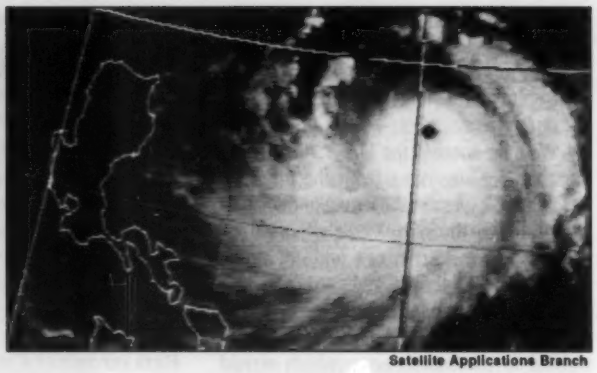

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Figure 7.— Supertyphoon Dinah at 0231 on the 26th.

Tropical Cyclones — Ten tropical cyclones roamed the North Pacific this month; four came to life in the west, five in the east and one in central waters.

Super typhoon Betty developed in the Philippine Sea on the 9th. During the 10th and 11th Betty underwent explosive deepening as central pressure dropped from 970 mb to 910 mb in 24 hr. Maximum sustained winds were estimated to have increased from 65 kn to about 120 kn during this period. This deepening was documented by data received at the Royal Observatory, Hong Kong. Betty reached peak intensity at 1200 on the 12th when pressure fell to 900 mb and sustained winds climbed to about 130 kn. As Betty crossed the Philippines (fig 5), an island station, about 40 mi to the southwest of the center, reported 97-kn winds. According to the press, Betty was the most devastating typhoon to hit the Philippines since Ike in 1984. Altogether 94 people were killed and some 700 thousand others rendered homeless. Damage was estimated at $32.8 million. Betty maintained typhoon strength until the 16th as it moved through the South China Sea (fig 6). It finally ended up over Vietnam on the 16th. Typhoon Cary popped up on the 13th just north of where Betty developed. It became a typhoon the following day and headed for the northern Philippines. Maximum winds climbed to 80 kn before Cary crossed Luzon on the 17th (fig 8). It hit the coast about 140 mi northeast of Manila, bringing strong winds and torrential rains. Continuing a westward trek Cary, dropped to tropical storm strength on the 21st as it approached Vietnam. According to press reports, at least 20 people were killed and several hundred injured in coastal provinces of Vietnam during Betty and Cary.

Meanwhile typhoon Dinah was coming to life east of Guam on the 21st. The storm moved eastward and attained typhoon strength on the 24th near 13°N, 136°E. It was beginning to recurve by this time. The following day maximum sustained winds were estimated at 115 kn. By the 26th (fig 7) Dinah was a supertyphoon sporting 130-kn winds around a center, which was crossing the 130th meridian near 18°N. The typhoon began to weaken as it moved northwestward into the East China Sea on the 29th. It maintained typhoon intensity until the 31st. Apart from hurricane force winds Dinah brought torrential rains to southern Korea and southwestern Japan. The press reported that in South Korea 23 people were killed, 52 were missing and nearly 12 thousand left homeless. In Japan three people were reported dead and one missing. Ed was spawned near the Marshall Is on the 22d. Moving northwestward it developed slowly. In fact it degenerated to a tropical wave. On the 26th near 16°N, 149°E it regenerated and at 0000 on the 27th was christened tropical storm Ed. Winds never climbed above 35 kn and Ed fell back to a tropical depression later in the day.

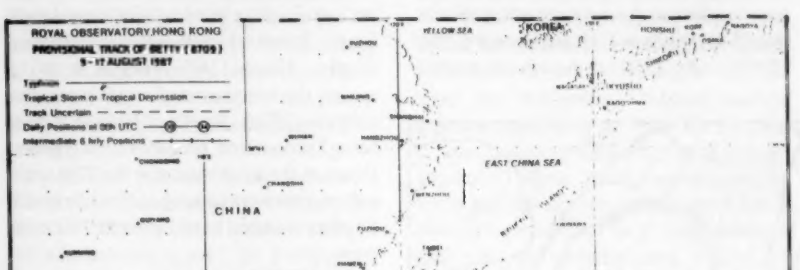

Figure 6.— Preliminary track courtesy Royal Observatory, Hong Kong.

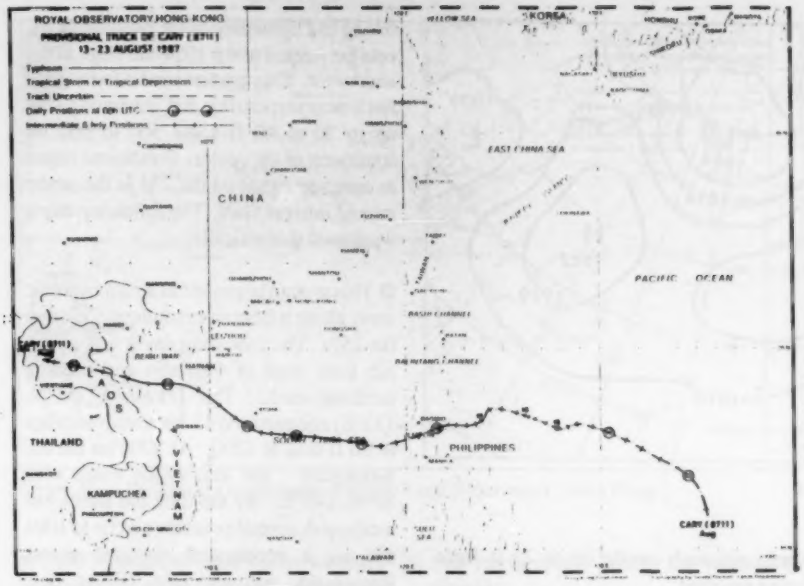

Figure 8.— Preliminary track courtesy of Royal Observatory, Hong Kong.

In the east Hilary was a short-lived hurricane that may have had its origins in July but spent the first week of August roaming the seas south of Mexico. Hilary reached hurricane strength on the 2d near 12°N, 99°W. Moving west northwestward winds climbed to 105 kn on the 4th, with gales extending out 120 mi. However this intensity didn't last long as winds quickly dropped back to 80 kn by the 5th. Hilary picked up again the following day when winds climbed to 95 kn for a few hours. As the storm crossed the 115th meridian, near 18°N, at 1200 on the 6th winds were estimated at 85 kn. Twenty four hours later Hilary was an tropical storm and it continued to weaken slowly over the next few days as it moved over cooler waters. Meanwhile hurricane Irwin had come to life on the 4th near 10°N, 92°W. Paralleling the Mexican coast Irwin never reached hurricane intensity. Maximum winds climbed to 50 kn on the 5th and increased to a peak of about 55 kn the following day. Irwin maintained his intensity until the 8th as it moved well offshore by Acapulco and Manzanillo. By the 9th Irwin had lost convection and was rapidly dissipating. A week went by with little activity and then during the last 2 weeks of the month there was a flurry as Jova, Knut and Lidia came to life in the east and Oka was spotted in central waters. Both hurricane Jova and tropical storm Oka threatened the Hawaiian Is but moved to the south. Jova became a hurricane on the 16th as it approached 130°W near 12°N. Once into central waters winds climbed to 90 kn by the 18th. Jova maintained hurricane intensity until late on the 19th near 15°N, 139°W. Oka came to life on the 26th, nearly 1100 mi southeast of Honolulu. The depression moved toward the west northwest and was upgraded to a tropical storm later in the day. late on the 27th, sporting 50–kn winds, Oka was about 600 mi south of Honolulu. It began to weaken on the 28th.

Lidia and Knut, an unlikely couple, came to life on the 29th. Knut formed near 10°N, 120°W and moved westward until the 30th when it dissipated. It was a minimal tropical storm. Lidia was another story. Beginning about 300 mi south of Acapulco, Lidia made it into September and reached hurricane intensity. This event took place on the 1st near 17°N, 114°W. Winds climbed to 75 kn that same day. However, as Lidia approached the 20th parallel it began to weaken. By the 2d the system was a degenerating tropical storm.

Casualties — During typhoon Betty a motor boat broke in two; 15 crewmen were rescued and 2 were missing off the coast of Quezon Province. Several vessels also ran aground and they included the ***Saratorn, Oil Queen, Diego Silang, Lake Taal*** and ***Regency***. During typhoon Dinah it was reported by Japanese Police that 13 fishing and recreation vessels were sunk or disabled. Also the ***Song Huong*** carrying 7,000 tons of coal ran aground south of Kyushu on the 30th. The ***Maw-La-Myaing***, a cargo carrier, was driven aground on a sandy beach in Fukuoka Prefecture. The Yonhap news agency reported a 99-ton fishing vessel was caught in the typhoon 200 mi east of Seoul, and left 32 fishermen missing with only one survivor.

September, 1987— The subtropical high dominated the North Pacific as usual (fig 9), however its influence extended more towards Japan and the result was a +7 mb anomaly centered near 45°N, 175°E. There were negative anomalies in the Gulf of Alaska and eastern Bering Sea, reflecting a higher than normal number of Lows in these waters. South of 30°N and west of 170°E negative anomalies in the -4 to -5 mb range were apparent. In the steering level (700 mb) there was a trough over China and Korea and another extending southward from Alaska. This resulted in storms moving in general, west to east with a tendency to curve northeastward toward the Gulf of Alaska east of 160°W.

On this date — September 26, 1959 — Typhoon Vera wreaked havoc throughout Japan. The death toll stood at 4580 people confirmed with another 658 missing. At that time Vera became Japan's greatest storm disaster. In less than 3 hr Vera turned Nagoya, a modern city, into a complete shambles. The harbor was described as a "sea of dead". At Handa, southeast of Nagoya, 300 people perished when gigantic waves battered the town destroying more than 250 houses.

Extratropical Cyclones — As is customary with the beginning of fall, storm activity over the shipping routes increase. The Gulf of Alaska was particularly vulnerable this year and several remnants of tropical systems added to the activity.

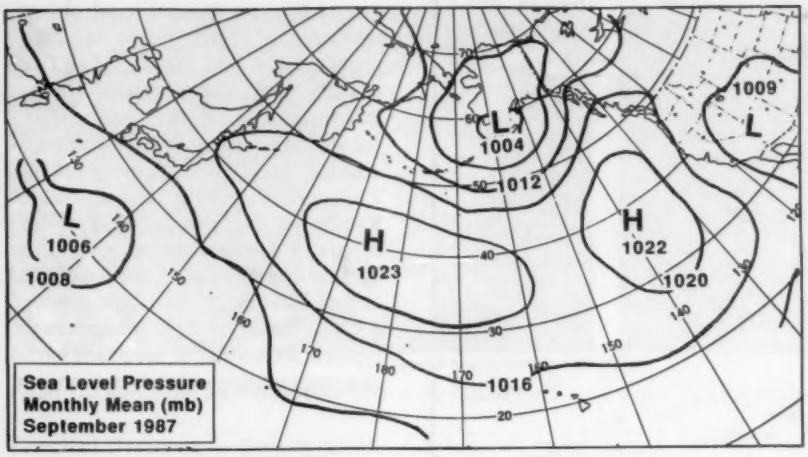

Figure 9.—The Aleutian Low makes its presence felt.

❶ This storm was originally typhoon Dinah in August. Now it had developed into a potent extratropical system in the southern Sea Okhotsk. By 0000 on the 2d its central pressure was down to 978 mb. A raft of ship reports came in with winds of 40 to 45 kn in seas of 10 to 15 ft with swells up to 20 ft. The reporting vessels included the ***Valdiva, Khotin, Lilac Ace*** and the ***Zubarevo***. The ***Valdiva*** also recorded a 986-mb pressure. At 0600 the ***Biana*** (47°N, 162°E) ran into 50-kn west southwest winds in 30-ft seas. Gales continued through the day, but began to abate on the 3d as the storm started to fill in the southeastern Bering Sea.

❷ A Gulf of Alaska storm had its beginnings over Manchuria on the 13th. Moving east northeastward it intensified slowly. On the 15th it swung northward through the Sea of Okhotsk and the following day moved eastward across Kamchatka. Once into the Bering Sea the storm deepened. At 0000 on the 16th the ***Kamtchatskaya Pravda*** encountered 43-kn easterlies near 60°N, 166°E. To the south of the center reports of 40-to 45- kn winds were common. By the 17th the 980-mb storm was moving into Bristol Bay and heading for the Gulf. At 1800 on the 18th, the ***Lilac Ace*** reported 45-kn southerlies near 47°N, 152°W. By this time the center had reached the Gulf and the following day it turned northeastward. Although the system covered the entire Gulf of Alaska and beyond, there were no gale reports in evidence although swells up to 25 ft were being reported.

❸ On the 18th the extratropical remnants of Freda and Holly combined into a potent 978-mb Low near 40°N, 155 °E. The ***Daiho Maru*** (49°N, 152°E) reported in with 58-kn winds from the north northeast at 0000 on the 19th. During the day the storm swung northward and then headed east northeastward toward the Gulf of Alaska. On the 20th several vessels radioed in 40-to 45-kn winds with swells of 15 to 20 ft. These ships included the ***Trans Ocean Transport II*** and the ***Khotin***. By 1200 the central pressure had dipped to 960 mb as the system moved into the southern Bering Sea. At 0000 on the 21st the ***Rybak Latvii***, some 300 mi northwest of the center, encountered 48-kn northerlies in 16-ft seas. Close to the center the ***Nobobiriooussinsky*** was nailed by 52-kn northeast winds in 10-ft seas. In general winds were blowing at 40 to 50 kn with seas of 10 to 15 ft. At 1800 three important reports were received. The ***Asean Liberty*** (53°N, 176°W) measured a 977-mb pressure in 20-ft seas, the ***Sea Bells*** (54°N, 179°W) measured a 980–mb pressure in 15–ft seas and the Washington Rainbow II reported 50–kn west northwest winds near 55°N, 178°W. The observations provided an excellent profile of a dangerous storm. The following day the storm edged closer to the Gulf of Alaska as its winds battered the Alaska Peninsula. There were some 50-kn wind reports on the back side of the Low, owing to a tightening of the pressure gradients between it and a 1034-mb High to the southwest. This gradient and a fairly good fetch was responsible for generating seas up to 30 to 40 ft some 500 to 600 mi southwest of the center. Conditions began to ease somewhat on the 23d as the center moved into the Gulf. The following day it weakened dramatically.

❹ This system began life as an atmospheric wave along a front over southern China on the 25th. The following day it was a 980-mb Low west of Sakhalin and heading northeastward. The ***Irkoutsk*** (41°N, 132°E) encountered 43-kn northwesterlies in 20 ft seas at 1200. At 0000 on the the ***Soungari*** ran into 47-kn winds near 59°N, 149°E. By the 28th the storm had weakened, central pressure was up to 1004 mb, as it accelerated eastward across Kamchatka and into the Bering Sea. However, it revived on the 29th and became a small but intense 986-mb Low by 1200. Pressure continued to drop as it approached Cape Avinov, AK. At 1800 on the 29th an unidentified vessel near 52°N, 171°W reported 42-kn westerlies in 13-ft seas. The storm moved ashore and began to weaken as the new month began.

Tropical Cyclones — Nine tropical cyclones came to life over the North Pacific this month; five developed in the west, three in the east and one in central waters.

A trio of typhoons showed up in the west during the first week of the month. Freda, Gerald and Holly spread a reign of terror across the tropical western North Pacific. Freda and Holly both reached typhoon strength on the 6th, while Gerald (fig 10) followed one day later. At the time all were centered south of 20°N, Freda near 141°E, Gerald near 126°E and Holly out at 163°E. All were moving, in general, toward the northwest. Reports from vessel were mainly those on the outskirts, which, while they aren't spectacular, still help the forecaster determine the extent of the storm's circulation. In this unusual case— a forecaster's nightmare — all help is appreciated. At 0000 on the 8th the ***Sanko Dignity***, 180 mi northeast of Gerald's center, reported 35-kn westerlies in 23-ft seas. Earlier the ***Kasturba*** (17°N, 124°E°) hit 45-kn northwesterlies in 13-ft seas. The ***Tai An Hai*** and the ***Nedloyd Dejima***

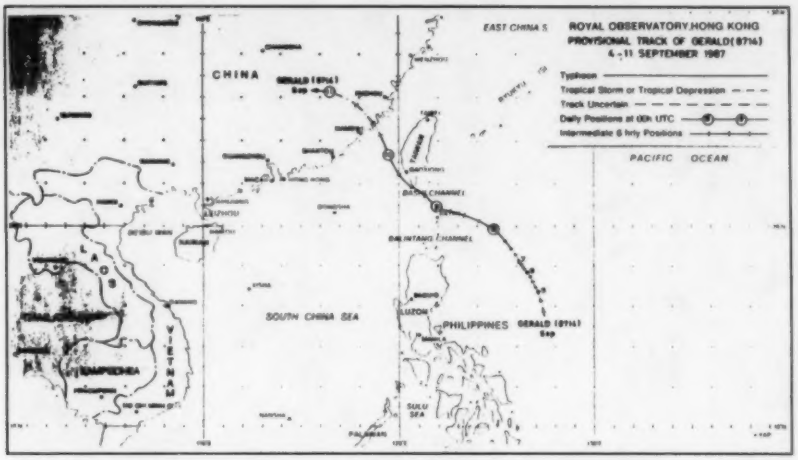

Figure 10.— Preliminary track courtesy of the Royal Observatory, Hong Kong.

at 1200 reported 47- and 41-kn winds respectively, under the influence of Gerald. By the 9th all were generating 100-kn winds or more near their centers. All had gales extending out to about 200 mi. Gerald had reached a peak when maximum winds climbed to 105 kn at 0000, as it moved into the Luzon St. Freda and Holly reached their peaks the following day. Freda's winds hit 125 kn at 0000 while Holly, which became a supertyphoon early on the 9th, reached a 140-kn peak on the 10th. On the 11th at 0000 the JHXJ near 17°N, 157°E, some 300 mi south of Holly's center ran into 54-kn west winds in 13-ft seas. By this time Gerald had moved ashore over mainland China just south of Fu-chou. When Gerald passed close to the island of Magong, maximum sustained winds in excess of 80 kn were reported.

Damage and casualties were reported in Taiwan when Gerald skirted the southern and western parts of the island. Altogether five people were killed, 26 were injured and another 15 were missing. Power supplies to 800 thousand homes were disrupted and over 12 thousand hectares of farmland were flooded. In Gaoxing, seven fishing boats were sunk and three ships were set adrift by the winds. Gerald also brought torrential rain to the coastal provinces of Fujian and Zhejiang in southeast China, where extensive damage occurred. According to press reports, 122 people were killed, 158 were injured and another 13 were missing. Two boats were also sunk in the coastal waters of Fujian and another two ran aground during the passage of Gerald.

Freda and Holly, meanwhile, were recurving northward. Holly dropped below supertyhphoon strength (130 kn) early on the 11th and by the 14th both were typical storms, but not entirely finished. Late on the 11th Holly's center passed very close to Minamitorishima, in the Volcano Islands, which reported gale force winds from the 10th through the 12th continuously. The ***Sanyo Maru***, close to Freda's center at 0500 on the 13th, encountered 50-kn winds in 23-ft swells; she also reported a 983-mb pressure. On the 18th the remnants of Freda and Holly combined to form a strong extratropical storm, reported on earlier.

Late in the month Ian and June came to life in the western North Pacific. Ian was spotted on the 22d near 15°N, 147°E while June popped up 3 days later near 17°N, 161°E. Moving northwestward, Ian reached typhoon intensity on the 25th. Maximum sustained winds climbed to 100 kn for a brief time on the 26th. Meanwhile June was turning a counterclockwise loop as a tropical depression. It finally headed northward on the 28th and crossed the 20th parallel near 158°E. June became a minimal tropical storm on the 29th as it turned toward the north northwest. It lasted at about this level until the beginning of October, when it weakened. Ian remained a typhoon until late on the 28th, but began to weaken as maximum winds fell to 55 kn on the 25th and below 35 kn by the lst of October.

In the central North Pacific hurricane Peke (pronounced Paykay), the Hawaiian equivalent of Becky, was detected on the 19th near 13°N, 162°W. By the 21st the ill–defined center of the tropical depression was about 1250 mi south of Honolulu and moving westward. The following day it took a turn toward the north, and intensified to tropical storm strength. On the 23d about 1260 mi southwest of Kauai, near 15°N, 177°W, Peke's winds climbed to 75 kn with gusts to 90 kn. Sporting 90-kn winds on the 24th hurricane Peke drifted toward the dateline (fig 11). The forward speed had dropped to about 3 kn. For the next several days the hurricane paralleled the dateline as if leery of making the transformation (in name only) to a typhoon. Finally, late on the 27th, Peke made the move toward the northwest and officially became typhoon Peke with maximum winds of 85 kn. The typhoon crossed the 30th parallel on the 30th, near 170°E, and began to recurve. As it turned back toward the southeast the system began to weaken. It dropped back to tropical storm strength on the lst and back to a tropical depression on the 3d.

Hurricane Max, which came to life on the 9th, became a hurricane by the 11th near 12°N, 109°W. Continuing to intensify quickly, Max's maximum winds reached 100 kn early on the 12th. Twenty four hours later the storm was generating 135-kn winds near the center with gales extending out to 170 mi. If Max had been in the western Pacific it would have been a supertyphoon. The hurricane continued on a northwestward path for the next few days. Cooler waters and upper level shearing contributed to a weakening that set in on the 14th. Winds fell below 135 kn early on that day and the following day Max dropped back to tropical storm intensity, near 21°N, 122°W. On the 16th it was a weakening tropical depression.

Meanwhile Norma had developed, on the 14th near 18°N, 111°W. It was at tropical storm strength the following day. Moving west northwestward Norma became a hurricane briefly on the 17th. By this time it had turned toward the north northwest and was heading for cooler waters. Norma weakened quickly. By 0000 on the 18th it was back to tropical storm intensity and the following day was a dissipating tropical depression. However, there

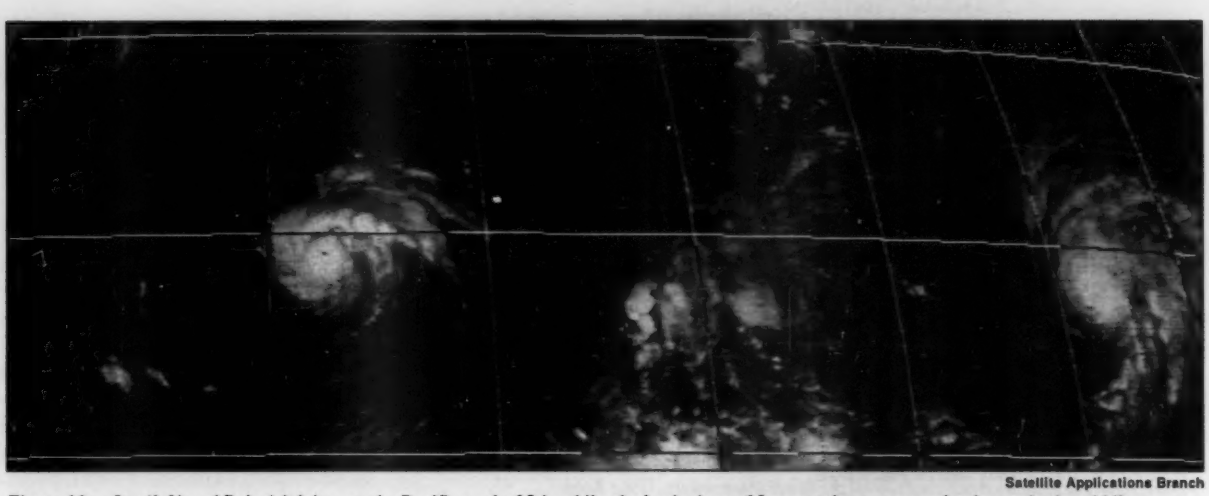

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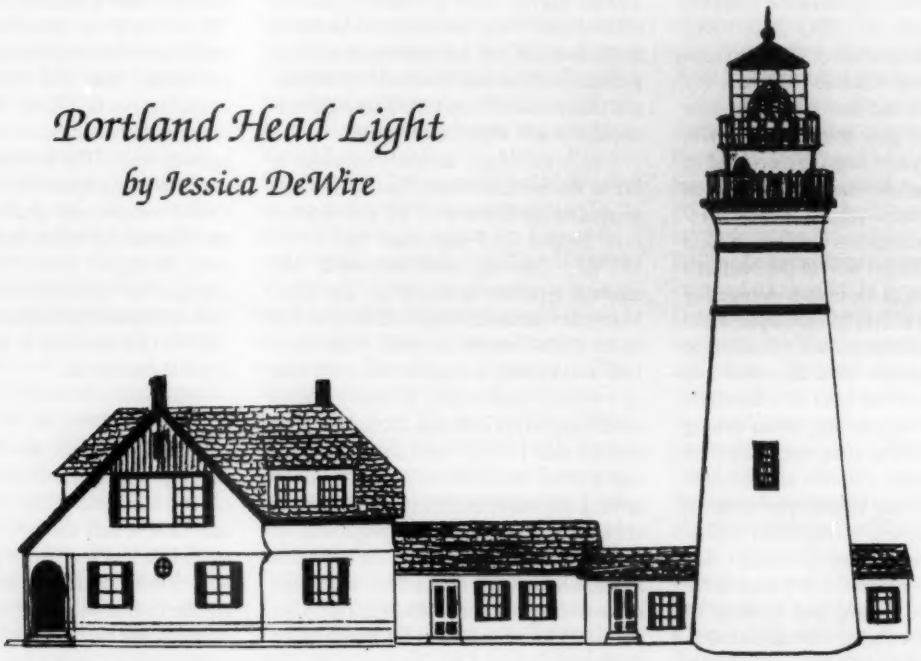
Figure 11.—Ian (left) and Peke (right) roam the Pacific on the 25th, while the beginnings of June can be seen as a cloud mass in the middle.

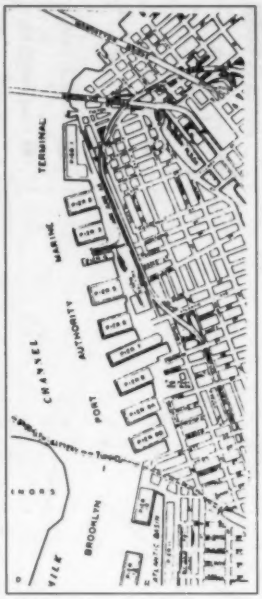
was no slack in tropical activity as Otis stepped in on the 20th, near 10°N, 119°W, to fill the void. Otis was the 18th tropical depression of the season in the eastern North Pacific. A tropical storm was in the offing on the 20th and by the 21st Otis achieved hurricane status near 13°N, 121°W. The storm continued to intensify as it started to recurve toward the north northwest. However, maximum winds continued to climb and reached 100 kn by the 22d and remained at about that level until the 24th as it turned west northwestward. Finally, cooler waters and upper level conditions began to take their toll and Otis started to weaken. The system dropped to tropical storm strength by 1200 on the 25th and was a tropical depression near 17°N, 134°W.

Casualties — During a local storm at Keelung, two crane barges, ***Ta-yeh*** and ***Ta-chin***, working offshore, sustained weather damage and anchor line failure during the 25th–26th and were in danger of being driven aground. Tugs could not render immediate assistance because of sea conditions. Finally assistance was provided.

Portland Head Light

by Jessica DeWire





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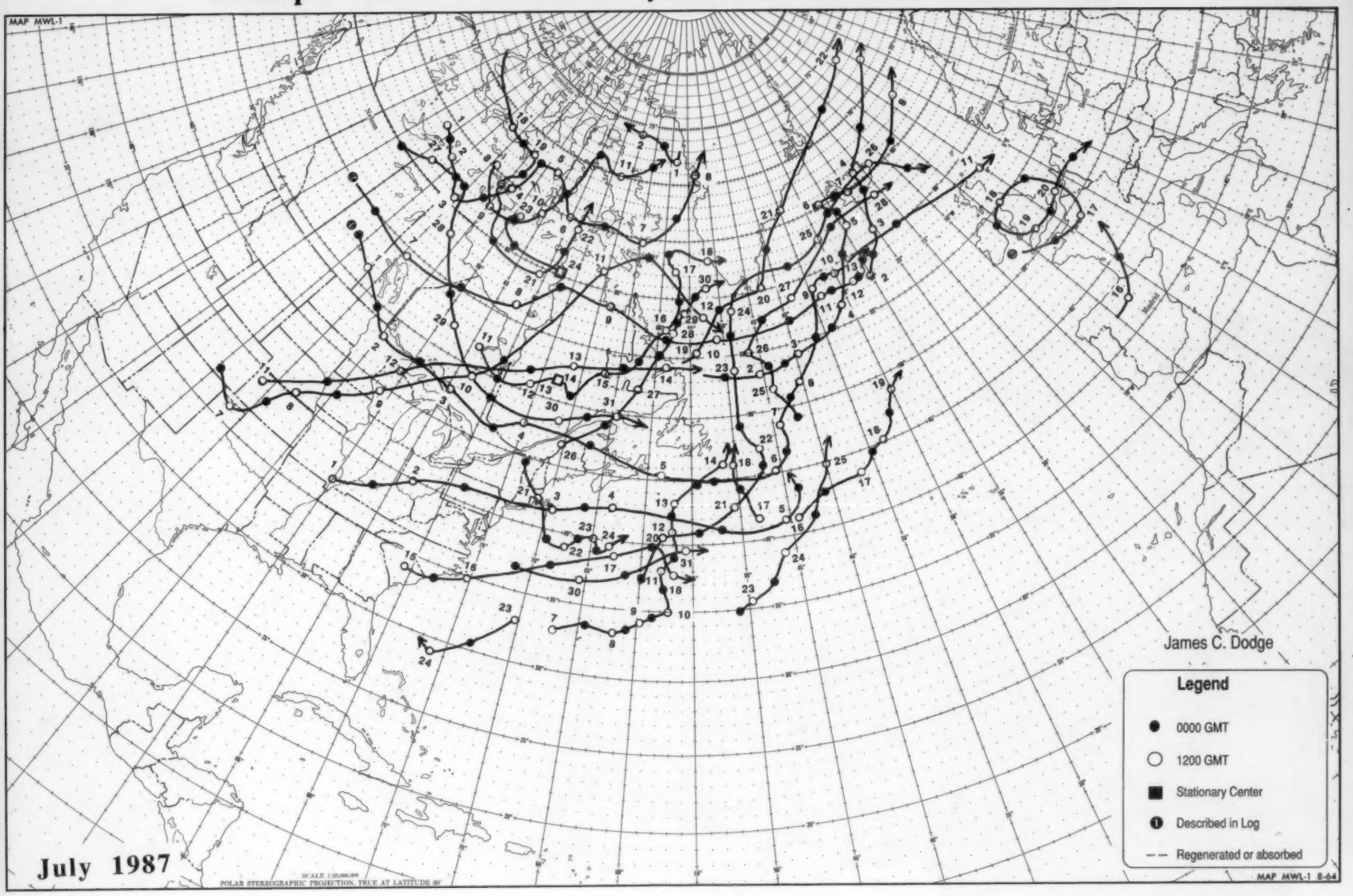
Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic



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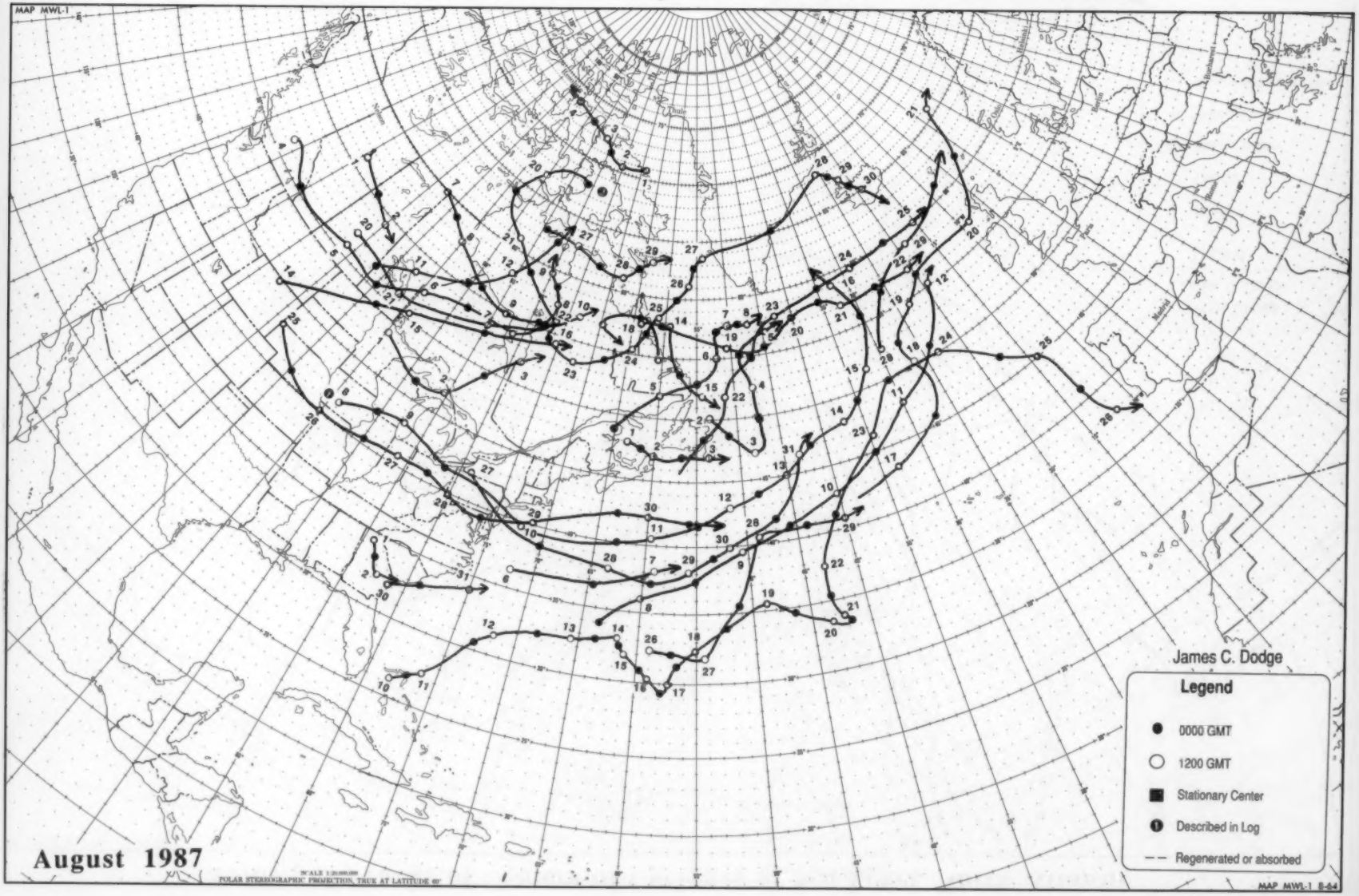

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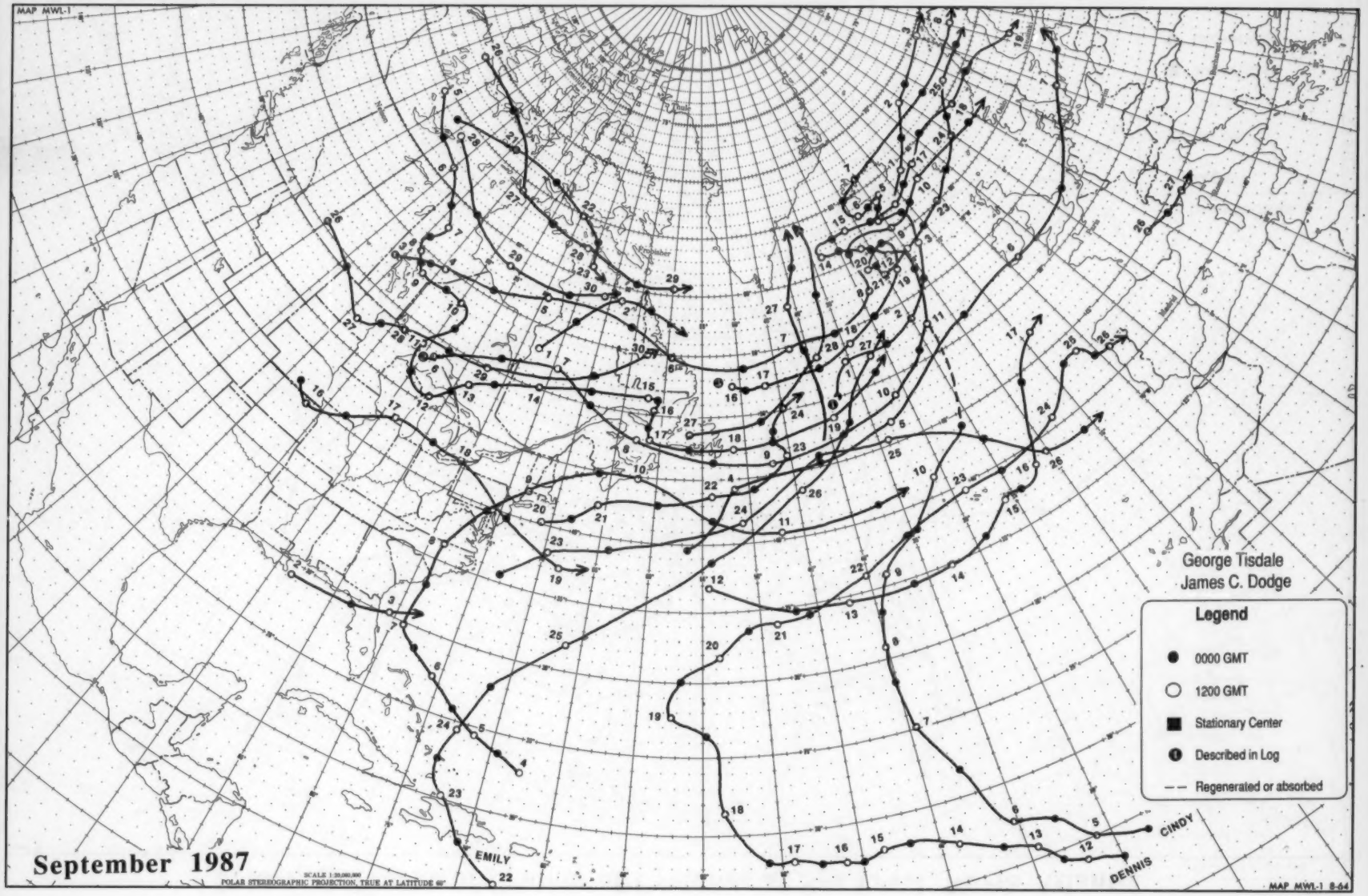

Principal Tracks of Centers of Cyclones at Sea Level, North Pacific

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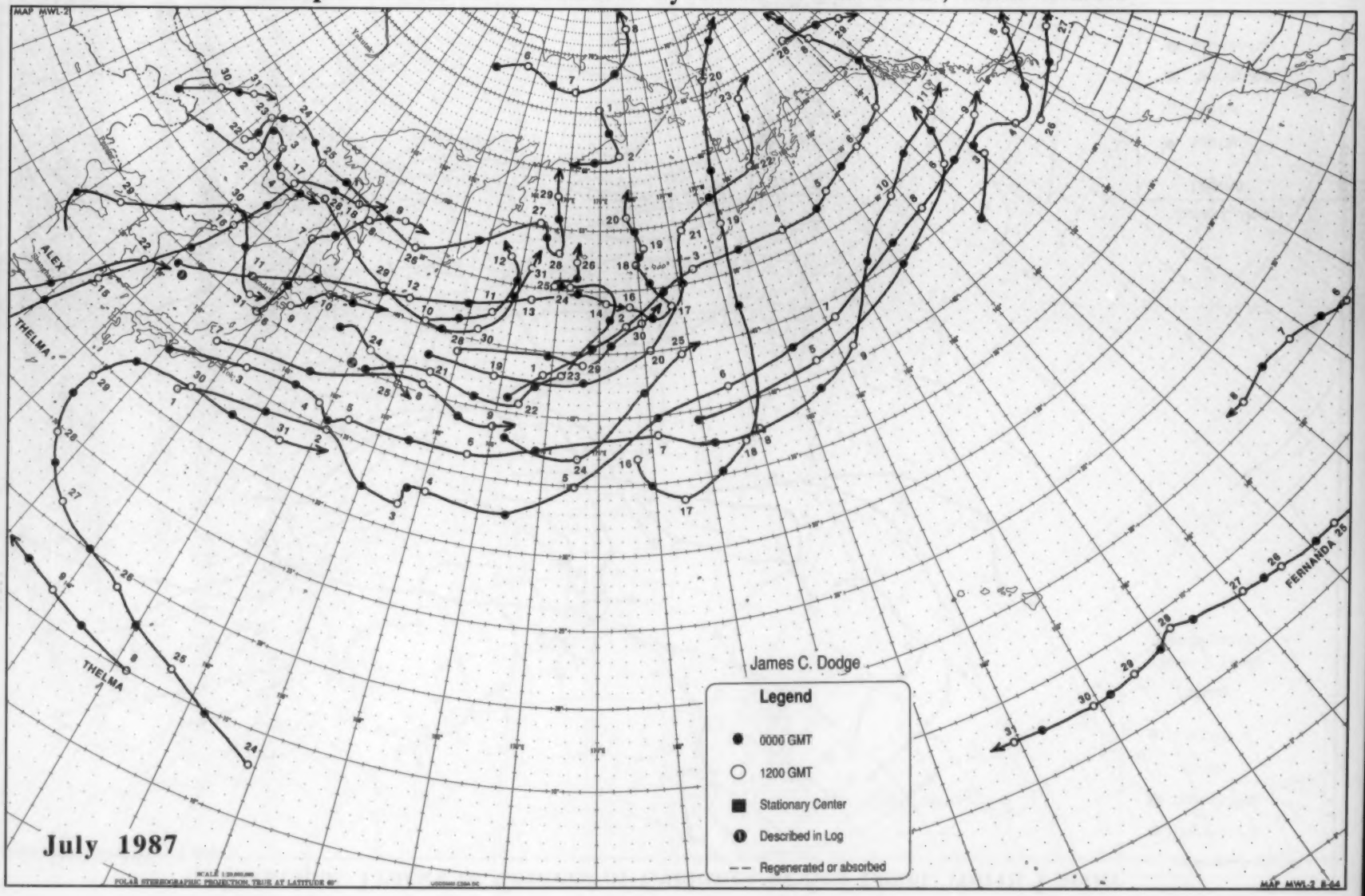

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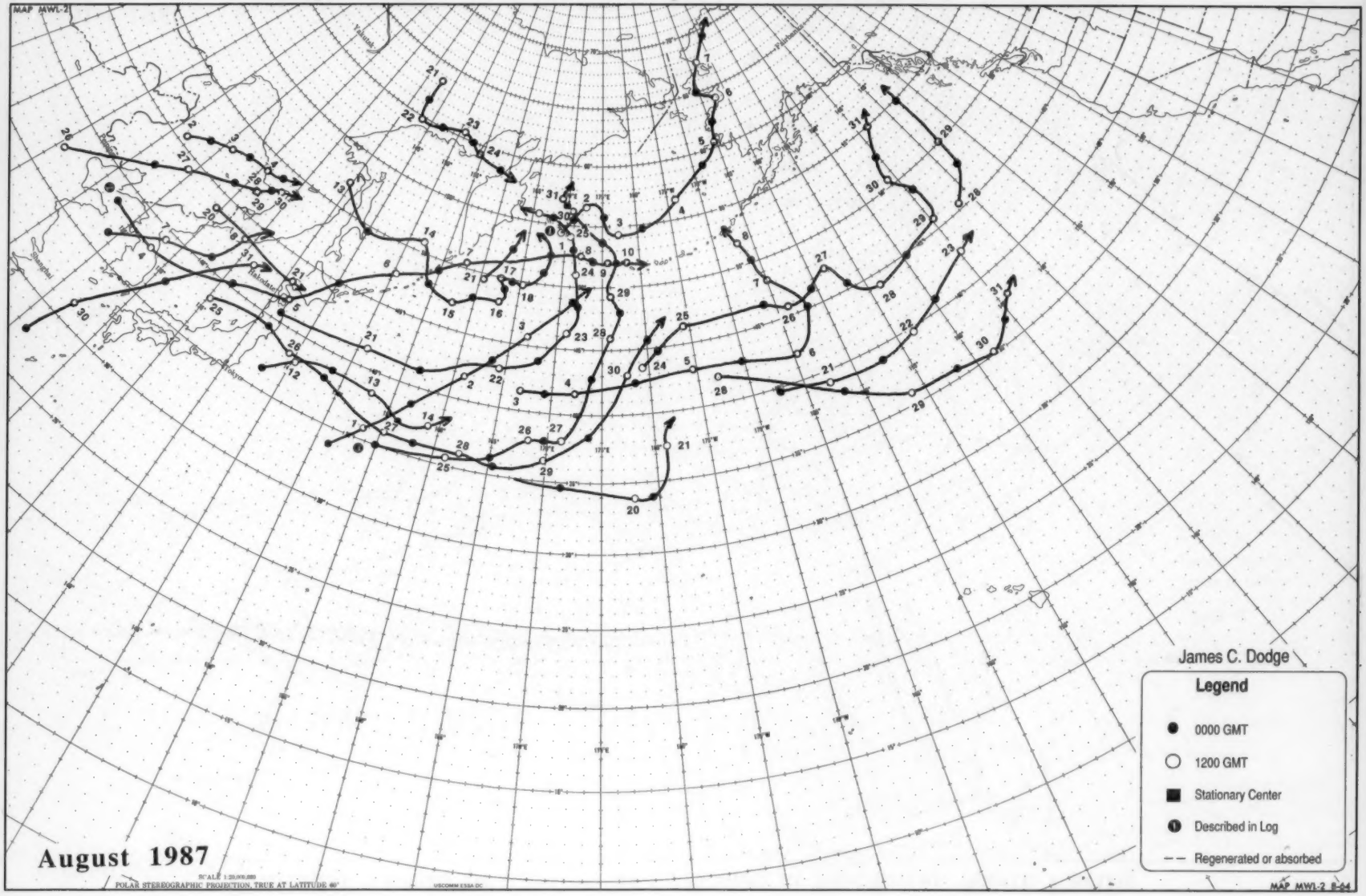
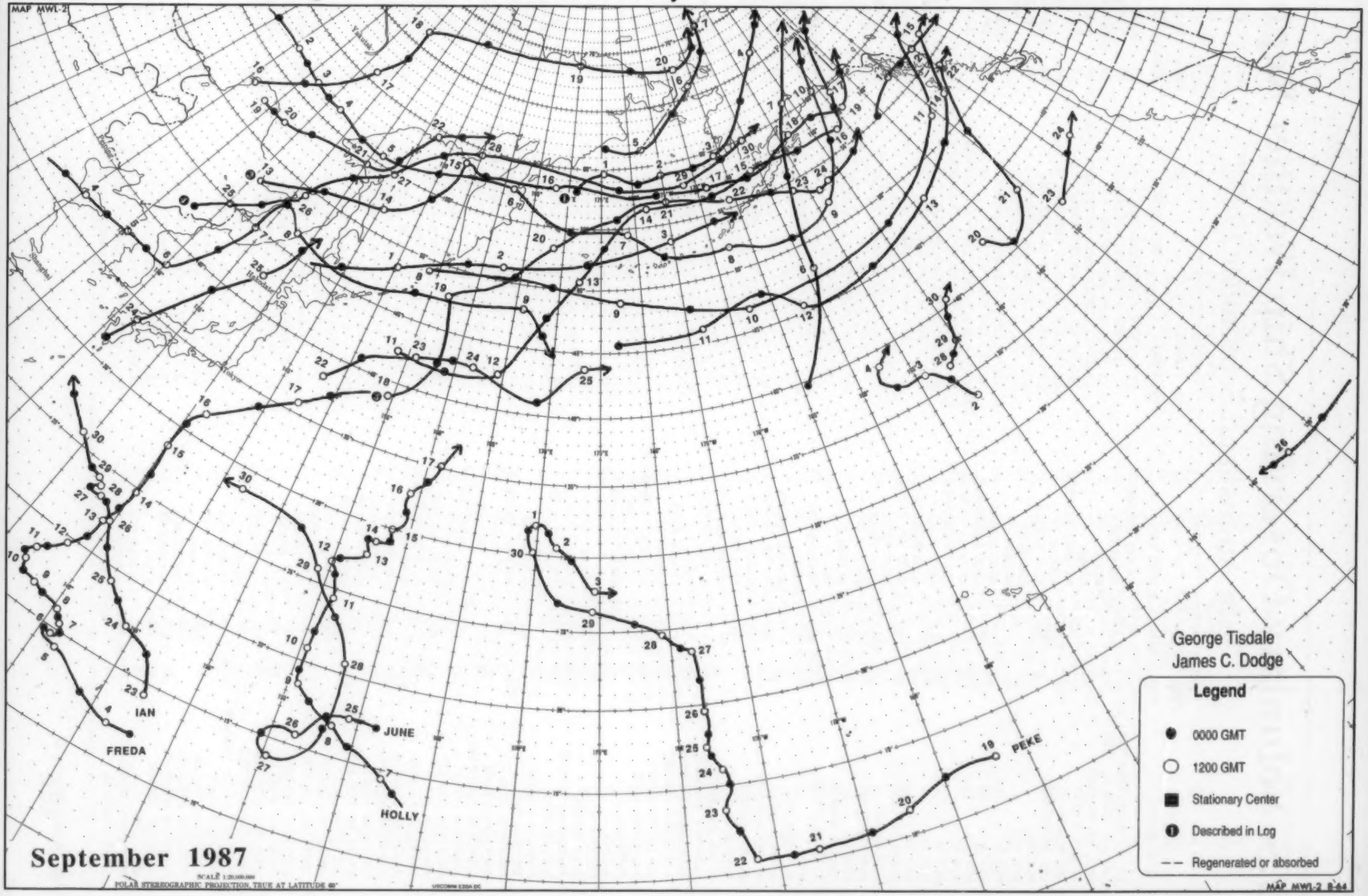


Principal Tracks of Centers of Cyclones at Sea Level, North Pacific



U.S. Voluntary Observing Ship Weather Reports

July, August and September 1987

SHIP NAME	VIA RADIO	VIA MAIL
1ST LT ALEX BONNYMAN	54	
2ND LT. JOHN P. BOBO	9	
ABUL KALAM AZAD	1	
ACADIA FOREST	15	
ACE ACCORD	89	157
ACE ENTERPRISE		200
ACT 10	19	31
ACT 111	111	
ACT 5	55	
ACT 6	84	
ACT 7	146	
ACT 9	92	
ACT I	123	
ACT II	43	51
ACT IV	47	
ADABELLE LYKES	81	108
ADDIRIYAH	9	
ADMIRALTY BAY	39	108
ADONIS	14	79
ADRIAN MAERSK	16	67
AFRICAN ADDAX	10	
AIDA	101	176
AL AHMADIAH	13	
ALASKA MARU	49	
ALASKA RAINBOW	19	91
ALBERT MAERSK	12	35
ALBULA		30
ALDEN W.CLAUSEN	9	
ALEMANIA EXPRESS	53	
ALLEMAGNA EXPRESS	23	26
ALLIGATOR FORTUNE	138	
ALLIGATOR GLORY	34	112
ALLIGATOR HOPE	73	118
ALMUDENA	22	21
ALTAIR	13	
ALTAMONTE	22	14
ALVA MAERSK	35	42
AMBASSADOR BRIDGE	203	78
AMELIA TOPIC	39	115
AMERICA EXPRESS	49	
AMERICA SUN	42	100
AMERICAN ARGO	13	49
AMERICAN CONDOR	19	
AMERICAN CORMORANT	21	
AMERICAN EAGLE	81	84
AMERICAN ENTENTE	19	190
AMERICAN ENVOY	42	155
AMERICAN FALCON	33	119
AMERICAN GEORGIA	24	
AMERICAN HARRISON	100	144
AMERICAN HAWAII	39	38
AMERICAN HERITAGE	7	42
AMERICAN LARK	22	75
AMERICAN LEGION	41	81
AMERICAN LIBERTY		43
AMERICAN MARINER		13
AMERICAN MARKETER	39	76
AMERICAN MERCHANT	58	124
AMERICAN MICHIGAN	29	83
AMERICAN NORTH CAROLIN	5	62
AMERICAN OHIO	3	5
AMERICAN PIONEER		172
AMERICAN REPUBLIC		115
AMERICAN RESOLUTE	28	31
AMERICAN TROJAN	42	66
AMERICANA	6	14
AMOCO BALTIMORE	19	42
AMOCO YORKTOWN	5	
ANDERS MAERSK	21	58
ANDERSON		80
ANITA	11	35
ANONA	17	
ANTHONY RAINBOW	24	
AQUA CITY	135	268
AQUA GARDEN	67	139
AQUARIUS	62	148
ARCHON	3	39
ARCO ALASKA	34	24
ARCO ANCHORAGE	16	8
ARCO CALIFORNIA	29	36
ARCO FAIRBANKS	23	
ARCO JUNEAU	26	27
ARCO PRUDHOE BAY	14	28
ARCO SAG RIVER	19	22
ARCO SPIRIT	33	27
ARCO TEXAS	17	4
ARCTIC TOKYO	7	198
ARGONAUT	37	189
ARIES	3	5
ARILD MAERSK	37	58
ARMCO	108	177
ARNOLD MAERSK	22	48
ARTHUR M. ANDERSON	133	227
ASHLEY LYKES	13	65
ASIA WINDS	60	
ASIAN HIGHWAY	42	
ASIAN VENTURE	5	
ASPEN	31	154
ATIGUN PASS	138	304
ATLANTIC	42	90
ATLANTIC COMPANION	54	
ATLANTIC RAINBOW	35	36
ATLANTIC SAGA	57	
ATLANTIC SERVICE	31	
ATLANTIC SONG	41	
ATLANTIC SPIRIT	17	36
ATLANTIC STAR	94	
AURORA	17	24
AUSTANGER	3	12
AUSTRAL RAINBOW	19	
AUSTRALIA	1	
B.T. ALASKA	17	56
B.T. SAN DIEGO	28	107
BABB ULLAH	7	62
BACOL SANTOS	11	
BALTIMORE TRADER	18	44
BAR' ZAN	15	
BARBER NARA	8	
BARBER PERSEUS	96	
BARBER PRIAM	1	
BARBER TAMPA	34	
BARBER TEXAS		10
BARBER TOBA	2	
BARRYDALE	35	
BAY BRIDGE	33	43
BCR KING	62	
BEAUTEOUS	17	
BELO RIO	3	
BENNINGTON	2	
BENSON FORD		138
BERNINA	21	96
BHARATENDU	2	
BHAVABHUTI	78	38
BIBI	54	
BISLIG BAY	83	
BOGASARI EMPAT	34	79
BOGASARI LIMA	62	206
BORINQUEN	45	147
BRINTON LYKES	58	
BROOKLYN	16	74
BROOKLYN BRIDGE	24	34
BROOKS RANGE	49	59
BULK GARLAND	34	
BUNGA KESIDANG	48	28
BUNGA MELAWIS	46	6
BUNGA SRIPAGI	1	
BURNS HARBOR		122
CALCITE II	68	99
CALIFORNIA RAINBOW	7	37
CALIFORNIA VENUS	9	
CAP ANAMUR	1	
CAPRICORN	2	12
CARIBE 1	29	64
CARLA A. HILLS	3	150
CASON J. CALLAWAY	98	146
CAVARA	86	44
CECILIE MAERSK	2	
CELEBRATION	24	78
CENPAC 2	24	
CGM LORRAINE	40	
CHABLIS	5	
CHARLES M. BEEGHLEY	29	122
CHARLOTTE LYKES	72	149
CHARLOTTE MAERSK	5	18
CHELSEA	55	187
CHERRY VALLEY	27	79
CHESAPEAKE TRADER	10	9
CHESNUT HILL	55	
CHEVRON ANTWERP	45	179
CHEVRON ARIZONA	12	55
CHEVRON BURNABY	60	223
CHEVRON CALIFORNIA	120	190
CHEVRON COLORADO	8	33
CHEVRON COPENHAGEN	28	82
CHEVRON EDIMBURGH	1	
CHEVRON EQUATOR	4	50
CHEVRON FELUY	22	39
CHEVRON FRANKFURT	12	
CHEVRON LONDON		18
CHEVRON LOUISIANA	34	68
CHEVRON MISSISSIPPI	117	59
CHEVRON NAGASAKI	53	259
CHEVRON OREGON	32	33
CHEVRON PACIFIC	30	27
CHEVRON SKY		236
CHEVRON STAR	43	187
CHEVRON SUN	12	105
CHEVRON WASHINGTON	63	112
CHIJIN	67	95
CHIKUMAGAWA MARU	7	
CHRISTIAN MAERSK	1	
CITADEL HILL	99	
CITY OF MIDLAND	77	283
CLARA MAERSK	3	
CLIFFORD MAERSK	7	59
CO-OP EXPRESS I	21	
CO-OP EXPRESS II	34	
CO-OP EXPRESS V	8	
COLIMA	8	74
COLORADO HIGHWAY	5	
COLUMBIA STAR		110
COLUMBUS AMERICA	63	
COLUMBUS AUSTRALIA	107	
COLUMBUS CALIFORNIA	83	
COLUMBUS LOUISANA	76	
COLUMBUS NEW ZEALAND	69	

SHIP NAME	VIA RADIO	VIA MAIL
COLUMBUS VICTORIA	158	
COLUMBUS VIRGINIA	104	
COLUMBUS WELLINGTON	116	
CONTINENTAL HIGHWAY	7	
CONTINENTAL LOTUS	8	
CONTINENTAL TRADER	34	
COPIAPO	1	12
CORNUCOPIA	33	139
CORONADO	59	15
COUNTESS-SKY	18	9
CPL. LOUIS J. HAUGE JR	31	132
CURRENT	50	53
CYGNUS	8	22
D.L. BOWER		85
DA MOSTO	6	26
DACEBANK	27	
DAIEI MARU	26	
DAMIAO DE GOIS	81	
DAVID PACKARD	3	
DAWN	72	94
DEL SUR	1	
DELAWARE TRADER	13	18
DEMOCRACY		48
DIANA	5	26
DILKARA	1	
DOCK EXPRESS TEXAS	63	
DRAGOR MAERSK	61	130
DUBHE	15	
DUSSELDORF EXPRESS	46	
DYUI SKAGERAK		142
E.R. BRUSSEL	4	
EASTERN FRIENDSHIP	17	109
EASTERN GLORY	23	69
EASTERN ROYAL	34	21
EDGAR B. SPEER		198
EDGAR M. QUEENY	2	
EDWIN H. GOTT		187
EL GAUCHO		48
ELBE MARU	136	
ELGAREN	106	
EMPIRE STATE	18	32
ENDEAVOR	29	102
ERNEST R. BREECH	64	227
EVER GAINING	6	60
EVER GATHER		31
EVER GENERAL	7	
EVER GENTLE	7	3
EVER GENTRY	6	24
EVER GIANT		12
EVER GIFTED	6	7
EVER GIVEN	8	11
EVER GLEAMY	7	18
EVER GLOBE	1	19
EVER GLORY	6	
EVER GOLDEN	9	10
EVER GOVERN	13	43
EVER GRACE	11	8
EVER GRADE	5	
EVER GRAND	3	
EVER GROUP	7	
EVER GROWTH	7	4
EVER GUARD	5	18
EVER GUEST	4	32
EVER GUIDE	4	
EVER LAUREL	1	
EVER LEVEL	35	30
EVER LINKING	10	
EVER LIVING	13	21
EVER LOADING	51	33
EVER LYRIC	42	15
EVER SHINE	8	20
EVER SUMMIT	19	59
EVER SUPERB	9	7
EVER VALOR	32	121
EVER VALUE	37	89
EVER VIGOR	11	
EVER VITAL	21	70
EVERSPRING	31	26
EXPORT CHALLENGER	8	25
EXPORT CHAMPION	26	72
EXPORT FREEDOM	33	89
EXPORT PATRIOT	24	79
EXXON BATON ROUGE	24	32
EXXON BAYTOWN	10	39
EXXON BENICIA	68	69
EXXON BOSTON	35	140
EXXON HOUSTON	35	74
EXXON JAMESTOWN	17	10
EXXON LEXINGTON	13	15
EXXON LONG BEACH	27	47
EXXON NEW ORLEANS	27	27
EXXON NORTH SLOPE	39	58
EXXON PHILADELPHIA	34	41
EXXON PRINCETON	8	17
EXXON SAN FRANCISCO	7	3
EXXON VALDEZ	19	51
EXXON WASHINGTON	4	2
EXXON YORKTOWN	10	11
FAIRWIND	1	
FALCON LEADER	27	
FALSTAFF	27	
FALSTRIA	46	76
FEDERAL LAKES	11	8
FEDERAL SEAWAY	36	56
FERNAO LOPES	63	167
FERNCROFT	119	181
FESTIVALE	1	
FETISH	62	103
FIRST LT JACK LUMMUS	6	
FJORD STAR	2	
FLORIDA RAINBOW	32	
FORTALEZA	39	118
FRANCIS SINCERE NO. 6	29	12
FREDERICKSBURG	5	71
FREMO SIRIUS	55	130
FROTASIRIUS	5	
GALLEON AQUAMARINE	2	
GALVESTON	24	31
GAS LIBRA	26	71
GEMINI	77	158
GENEVIEVE LYKES	16	18
GENISTA	11	
GEORGE A. SLOAN	146	140
GEORGE A. STINSON		62
GERONIMO	216	
GLACIER BAY	33	90
GLOBAL FRONTIER	51	96
GLOBAL PIONEER	48	33
GLORIA	3	15
GLORIOUS SPICA	100	
GLORITA		21
GLORY SPIRIT	32	37
GOLDEN APO	10	
GOLDEN BLISS	19	
GOLDEN GATE	2	
GOLDEN GATE BRIDGE	140	44
GOLDEN HAWK	83	128
GRACE ISLAND	4	
GREAT LAND	153	69
GREEN HARBOUR	51	
GREEN ISLAND	52	77
GREEN MASTER	61	62
GREEN MAYA	56	90
GREEN RAINIER	14	61
GREEN SASEBO	18	67
GREEN VALLEY	47	
GREEN WAVE	11	20
GUAICURI	58	96
GULF IDEAL	23	
GYPSUM COUNTESS	136	
GYPSUM KING	278	
H,J, KAISOR		69
H.J. HAYNES		238
HAI JUNG	4	13
HAKUSAN	27	
HAKUSAN MARU	105	
HANJIN HONG KONG	27	17
HANJIN KOBE	14	21
HANJIN KUNSAN	7	68
HANJIN KWANGYANG	1	15
HANJIN LONG BEACH	6	
HANJIN POHANG	17	14
HANJIN SAVANNAH	6	8
HANJIN SEOUL	1	
HASSAN MERCHANT	50	46
HEERENGRASHT	15	
HENRY FORD II		55
HERBERT C. JACKSON	5	15
HIKAWA MARU	138	
HIRA MARU	98	
HIYOSHI MARU	73	
HOEGH CAIRN	2	
HOEGH CLIPPER	5	
HOEGH DRAKE		45
HOEGH DUKE	58	
HOEGH DYKE	1	40
HOEGH MARLIN	11	104
HOEGH MASCOT	8	55
HOEGH MINERVA	11	
HOEGH MIRANDA	6	
HOHSING ARROW	29	136
HOHSING BREEZE	22	46
HOLIDAY	10	164
HOMERIC	10	31
HONOLULU	43	
HRELJIN	28	
HYUGA MARU	66	
HYUNDAI #101	29	44
HYUNDAI #18	8	
HYUNDAI CHALLENGER		181
HYUNDAI EXPLORER	12	22
HYUNDAI PIONEER	1	11
INDONESIA VICTORY	23	
INGER	32	37
IRVING ARCTIC	50	
IRVING MIAMI	35	
ISLA BARTOLOME	2	
ISLAND HOPE		90
ISLAND PRINCESS	50	
ITALICA	23	36
J.A.W. IGLEHART	10	66
J.L. MAUTHE	8	44
J.T. HIGGINS		132
JADRAN	13	
JALAPA	1	
JALISCO	57	111
JAMES LYKES	7	17
JAMES R. BARKER		122
JAPAN ALLIANCE	118	114
JAPAN APOLLO	100	107
JEAN LYKES	25	44
JOHN G. MUNSON	75	113
JOHN LYKES	9	42
JOSEPH L. BLOCK		192
JOSEPH LYKES	36	121
JOVIAN LILY	80	111
JOVIAN LUZON	19	7
JUBILEE		41
JUDITH PROSPERITY	21	8
JULIUS HAMMER		24
KALAYAAN	86	
KALIDAS	47	57
KASINA	34	28
KASTURBA	24	53
KAUAI	73	195
KEE LUNG	48	
KEISHO MARU	50	126
KENAI	7	57

SHIP NAME	VIA RADIO	VIA MAIL
KENNETH E. HILL	31	159
KENT	76	136
KEYSTONE CANYON	29	106
KEYSTONER	30	173
KITTANNING	14	40
KNORR	19	21
KOFUKU MARU	21	52
KOLN EXPRESS	46	
KOREAN JACEWON	46	
KOREAN WONIS JIN	19	14
KOREAN WONIS ONE	42	108
KOREAN WONIS SEVEN	21	28
KOREAN WONIS SUN	11	29
KUROBE MARU	1	
LA PAMPA	11	
LANAI	13	
LANCASHIRE	2	
LANETTE	18	27
LARS MAERSK	38	62
LAURA MAERSK	24	54
LAWRENCE A. GIANELLA	14	
LEDA MAERSK	32	87
LEISE MAERSK	28	97
LEO	1	
LERMA	81	
LESLIE LYKES	12	79
LETITIA LYKES	42	21
LEWIS WILSON FOY		333
LEXA MAERSK	20	94
LIBERTADOR GRAL SAN MA	10	
LICA MAERSK	48	102
LING LEO	38	167
LIRCAY	31	93
LLOYD VITORIA	9	89
LNG TAURUS	17	100
LONG BEACH	26	34
LONG LINES	4	20
LOTUS ACE	91	
LOUIS MAERSK	41	100
LOUISE LYKES	71	99
LPG HARDANGER		184
LT. ODYSSEY	12	
LURLINE	44	187
LUZON	15	47
LYRA	52	45
M. P. GRACE	50	
M.S. NOSAC SKAUKAR	46	88
M.V. IBIS ARROW	63	101
M/V LILLOOET	37	59
MADAME BUTTERFLY	33	54
MADANG	4	
MAERSK TACOMA	58	91
MAERSK WAVE	6	58
MAJ SANDVED	14	21
MAJ. STEPHEN W. PLESS	11	
MALAKAND	1	
MALLORY LYKES	44	95
MANGAL DESAI	37	85
MANUKAI	104	188
MANULANI	54	172
MARABANK	1	
MARATHA MELODY	8	
MARATHA SHOGUN	4	27
MARGARET LYKES	94	158
MARIA TOPIC	4	
MARIF	26	37
MARITIME NOBLE	127	
MARJORIE LYKES	23	31
MAUI	78	205
MC KINNEY MAERSK	28	92
MEDALLION	90	33
MEDUSA CHALLENGER	50	170
MEGHAN	6	
MELVILLE	113	183
MENINA BARBARA	30	133
MERAK EIGHTY	17	18
MERIDA	40	
MESABI MINER		178
MICROBA	12	69
MICRONESIAN COMMERCE	16	40
MICRONESIAN INDEPENDEN	94	80
MIDDLETOWN	102	147
MILTA	23	70
MING MOON	5	9
MING OCEAN	14	
MING PEACE	1	53
MING PLEASURE	23	45
MING PROMOTION	18	36
MING PROPITIOUS	28	11
MING SPRING	29	
MING STAR	1	21
MING SUN	4	
MOANA PACIFIC	248	182
MOBIL ARCTIC	23	101
MOBIL MERIDIAN	110	189
MOKU PAHU	156	229
MORMACSKY	30	
MORMACSTAR	7	13
MORMACSUN	36	71
MOSAC BRANCO	65	37
MOSEL EXPRESS	75	
MV BANGLAR MAMATA		72
MV GREEN ANGELES	15	46
MV HERMENIA	4	38
MV HOLCK LARSEN	10	38
MV JEBELAU	32	24
MV MARGARITA	9	71
MV MARLIN	32	173
MV MEGA HILL	68	42
MV NEW ORION		67
MV SAMU	11	34
MV SPRING VEGA	4	22
MV WESTWOOD BELINDA	4	14
MYRON C. TAYLOR	56	103
NANCY LYKES	5	
NATIONAL DIGNITY	32	82
NATIONAL HONOR	12	46
NATIONAL PRIDE	13	
NAVIGATOR		20
NAVIOS ENTERPRISE	28	
NEDLLOYD ELBE	124	
NEDLLOYD KATAJK	103	
NEDLLOYD KEMBLA	89	
NEDLLOYD KIMBERLEY	57	
NEDLLOYD KINGSTON	92	
NEDLLOYD KYOTO	88	
NEDLLOYD ROCHESTER	108	
NEDLLOYD ROSARIO	67	
NEDLLOYD ROTTERDAM	105	
NEDLLOYD ROUEN	126	
NEPTUNE ACE	87	
NEPTUNE AMBER	76	238
NEPTUNE CORAL	119	251
NEPTUNE DIAMOND	191	
NEPTUNE GARNET	65	
NEPTUNE IVORY	112	
NEPTUNE KIKU	32	
NEPTUNE PEARL	104	153
NEPTUNE TOURMALINE	21	
NEW HORIZON		251
NEW INDEPENDENCE	59	
NEW JERSEY MARU	104	
NEW YORK MARU	103	
NISSAN LAUREL	26	
NISSAN MARU	144	
NOAA DAVID STARR JORDA	150	158
NOAA SHIP ALBATROSS IV	311	424
NOAA SHIP CHAPMAN	314	294
NOAA SHIP DAVIDSON	267	359
NOAA SHIP DELAWARE II	287	351
NOAA SHIP DISCOVERER O	303	413
NOAA SHIP FAIRWEATHER	190	237
NOAA SHIP FERREL	206	249
NOAA SHIP HECK 591	54	98
NOAA SHIP JOHN N COBB	20	36
NOAA SHIP MCARTHUR	310	445
NOAA SHIP MILLER FREEM	83	
NOAA SHIP OCEANOGRAPHE	252	5
NOAA SHIP OREGON II	302	399
NOAA SHIP RAINIER	183	35
NOAA SHIP RESEARCHER	350	470
NOAA SHIP RUDE 590	20	49
NOAA SHIP SURVEYOR	127	
NOAA SHIP T. CROMWELL	408	340
NOAA SHIP WHITING	385	471
NORDHVAL	92	78
NOSAC EXPRESS	20	32
NOSAC SEL	34	151
NOSAC STAR	2	24
NOSAC TAKARA	16	40
NOSAC TAKAYAMA	137	219
NOSAC TRIGGER	35	236
NOSAC VERDE	46	132
NURNBERG EXPRESS	45	
OAK PEARL	24	
OAKLAND	133	193
OBERON	3	19
OCEA COMMANDER #1	1	
OCEAN COMMANDER #1	71	51
OCEAN GLORY	10	39
OCEAN LEGEND	38	
OCEAN STEELHEAD	33	130
OCTA	23	14
OJI GLORIA	61	
OLEANDER	163	126
OLGA TOPIC	19	23
OLIVE ACE	16	114
OMI CHAMPION	7	19
OMI CHARGER	10	26
OMI DYNACHEM		21
OMI WILLAMETTE	18	
ORANGE BLOSSOM	18	53
ORANGE STAR	4	46
ORCHID	1	82
ORCHID #2	27	96
OREGON RAINBOW	10	149
ORIENTAL DIPLOMAT	14	52
ORIENTAL EDUCATOR	114	248
ORIENTAL EXECUTIVE	43	226
ORIENTAL EXPLORER	92	190
ORIENTAL FAIR	66	154
ORIENTAL FAITH	32	27
ORIENTAL FORTUNE	23	63
ORIENTAL FRIENDSHIP	80	
ORIENTAL KNIGHT	17	
ORIENTAL MINISTER	8	14
ORIENTAL PATRIOT	29	108
ORIENTAL PHOENIX	7	245
ORIENTAL PRINCE	103	
ORIENTAL TAIO	8	
ORION HIWAY	32	
OVERSEAS ALICE	25	
OVERSEAS ARCTIC		16
OVERSEAS BOSTON	4	
OVERSEAS CHICAGO	19	36
OVERSEAS HARRIET	22	56
OVERSEAS JUNEAU	16	27
OVERSEAS MARILYN	38	121
OVERSEAS NEW YORK	39	77
OVERSEAS VALDEZ	52	120
OVERSEAS VIVIAN	24	67
OVERSEAS WASHINGTON	80	99
PACBARON	4	
PACBARONESS	31	
PACDUCHESS	9	
PACDUKE	7	
PACIFIC ANGEL	23	29
PACIFIC ARROW	119	47

SHIP NAME	VIA RADIO	VIA MAIL
PACIFIC CLIPPER	10	
PACIFIC DOWN	11	
PACIFIC HIGHWAY	123	
PACIFIC PRINCESS	50	
PACIFIC RAINBOW	50	111
PACIFIC VENTURE	38	
PACIFIC VICTORY	16	
PACIFIC WING	40	
PACKING	87	
PACMAJESTY	9	
PACMERCHANT	24	
PACMONARCH	44	20
PACNOBLE	9	
PACPRINCE	15	
PACPRINCESS	26	
PAN DYNASTY	1	
PANAMA	9	17
PANCALDO	4	
PATRIOT	28	62
PAUL BUCK	12	19
PAUL PIGOTT	1	
PAUL THAYER		64
PAWNEE	19	57
PECOS	8	
PEGGY DOW	179	
PENNSYLANIA RAINBOW		90
PENNSYLVANIA TRADER	71	108
PETERSFIELD	136	
PFC EUGENE A. OBREGON	16	5
PFC WILLIAM B. BAUGH	15	47
PFC. JAMES ANDERSON JR	12	24
PHILADELPHIA	31	88
PHILIP R. CLARKE	145	245
PHILIPPINE VICTORY	23	4
PHILLIPS MEXICO	2	
PILAR	1	
PLANTIN	26	
POLAR ALASKA	3	197
POLYNESIA	196	123
PONCE	59	138
POTOMAC TRADER	23	24
PRESIDENT ADAMS	31	66
PRESIDENT ARTHUR	70	230
PRESIDENT BUCHANAN	64	140
PRESIDENT CLEVELAND	31	95
PRESIDENT EISENHOWER	118	174
PRESIDENT F. ROOSEVELT	86	126
PRESIDENT FILLMORE	27	79
PRESIDENT GARFIELD	71	222
PRESIDENT GRANT	71	152
PRESIDENT HARDING	67	226
PRESIDENT HOOVER	79	145
PRESIDENT JACKSON	60	122
PRESIDENT JEFFERSON	78	54
PRESIDENT JOHNSON	83	197
PRESIDENT KENNEDY	35	46
PRESIDENT LINCOLN	154	220
PRESIDENT MADISON	19	20
PRESIDENT MC KINLEY	33	27
PRESIDENT MONROE	97	151
PRESIDENT PIERCE	23	
PRESIDENT TAYLOR	10	
PRESIDENT TYLER	88	222
PRESIDENT VAN BUREN	26	75
PRESIDENT WASHINGTON	178	260
PRESIDENT WILSON	33	
PRESQUE ISLE		345
PRIDE OF TEXAS	6	
PRIMORE	12	42
PRINCE OF TOKYO	97	265
PRINCE WILLIAM SOUND	12	29
PRINCESS DIAN	81	178
PROSPERIDAD	36	176
PROSPERITY QUEEN	30	
PUERTO RICO	107	90
PUNTA BRAVA	8	13
PVT HARRY FISHER	14	
QUEEN ELIZABETH 2	88	
QUEEN OPAL	52	35
RAINBOW BRIDGE	81	58
RAINBOW HOPE	45	
RED ARROW	6	
REGINA MAERSK	29	77
RHEIN EXPRESS	84	
RICHARD G MATTIESEN	180	
RICHARD REISS	7	16
RIMBA SEPETIR	4	
RIO ESQUEL	61	39
RIO FRIO	50	
RIO GRANDE	1	
RIO LIMAY	59	36
ROACHBANK	18	
ROBERT CONRAD	100	33
ROBERT E. LEE	16	
RODIN	120	
ROGER R. SIMONS	31	91
ROSARIO DEL MAR	4	
ROSINA TOPIC	17	10
ROSTAND	59	
ROTTERDAM	37	
ROUSSEAU	28	
ROYAL PRINCESS	95	
RUTH LYKES	39	93
RV CALANUS		31
RV WELCOMA		166
S.S. BAYAMON	12	27
S.S. COURTNEY BURTON	27	56
S.S. ROVER	16	115
S/S NORWAY	20	22
SAM HOUSTON	15	24
SAM LAUD		13
SAMOAN REEFER	92	185
SAMUEL H. ARMACOST	19	
SAN JUAN	76	199
SAN MATEO VICTORY	32	
SANKO AZALEA		11
SANKO CONDOR	21	
SANKO DIGNITY	2	
SANKO DILIGENCE		36
SANKO ETERNITY	11	
SANKO GOLD	15	57
SANKO HAWK	23	
SANKO LAPIS	33	79
SANKO LILY	24	
SANKO PEACE	25	65
SANKO PEACOCK	6	
SANKO PEARL	12	
SANKO STORK	2	
SANKO SWIFT		16
SANSINENA II	13	48
SANTA ADELA	47	125
SANTA CRUZ II	90	
SANTA JUANA	68	221
SATSUNA MARU	14	
SATURN DIAMOND	9	
SAUDI DIRIYAM	26	
SAVANNAH	95	
SCANDINAVIAN HIGHWAY	140	
SEA BELLS	49	56
SEA DIAMOND	66	182
SEA FAN	64	68
SEA FORTUNE	32	45
SEA HAVEN		49
SEA JADE	22	26
SEA LANTERN	52	109
SEA LIGHT	26	104
SEA TRANSPORTER	114	
SEALAND ADVENTURER	44	119
SEALAND ANCHORAGE	5	33
SEALAND BOSTON	7	29
SEALAND CONSUMER	53	173
SEALAND DEFENDER	63	167
SEALAND DEVELOPER	56	194
SEALAND ECONOMY	45	178
SEALAND ENDURANCE	25	158
SEALAND EXPLORER	51	129
SEALAND EXPRESS	52	134
SEALAND FREEDOM	35	35
SEALAND INDEPENDENCE	40	144
SEALAND INNOVATOR	41	142
SEALAND LEADER	56	199
SEALAND LIBERATOR	60	137
SEALAND MARINER	52	149
SEALAND PATRIOT	89	240
SEALAND PIONEER	35	164
SEALAND PRODUCER	28	175
SEALAND VENTURE	52	70
SEALAND VOYAGER	106	191
SEDCO/BP 471	45	82
SENATOR	1	
SEVEN OCEAN	39	64
SGT WILLIAM R BUTTON	5	24
SGT. METEJ KOCAK	4	9
SHELDON LYKES	70	173
SHELLY BAY	16	27
SHENAHON	50	48
SHIN BEISHU MARU	34	
SHINKASHU MARU	55	
SHIRLEY LYKES	29	60
SILVER CLIPPER	35	
SILVER STAR	48	48
SILVER VICTORY		30
SINGA ACE	47	58
SINGAPORE VICTORY	1	61
SIOUX TATE	21	
SKANDERBURG	23	35
SKAUBORD	62	90
SKAUGRAN	99	47
SKRIM	206	
SOARER CUPID	27	23
SOARER DIANA	35	116
SOLON TURMAN	16	62
SONG OF NORWAY		9
SOPHIA	118	
SOUTHLAND STAR	112	
SPRING BEAR	81	
SPRING BRIDE	1	
SS BAYAMON		14
SS MAUNALEI	44	162
SS RESERVE	2	12
SS SUE LYKES		65
STAR DIEPPE	46	
STAR EAGLE	50	37
STAR GRAN	2	60
STAR HONGKONG	71	
STAR OF TEXAS	66	
STAR THAILAND	15	73
STARWARD	1	
STELLA LYKES	20	43
STEWART J. CORT		219
STOLT LION	1	
STONEWALL JACKSON	18	30
STRATHCONON	104	
STRIDER	35	90
STRIDER CRYSTAL	12	16
STUTTGART EXPRESS	62	
SUGAR ISLANDER	4	253
SUN PACIFIC II	13	64
SUN VIKING	30	98
SUNBELT DIXIE	99	109
SUNORA	19	46
SYOSSET	21	17
TABASCO	41	75
TAI CORN	18	
TARGET	64	59
TESTER	80	97
TEXACO CALIFORNIA	15	34
TEXACO CONNECTICUT	4	

SHIP NAME	VIA RADIO	VIA MAIL
TEXACO FLORIDA	7	11
TEXACO GEORGIA		50
TEXACO MASSACHUSETTS	2	
TEXACO RHODE ISLAND	13	7
TFL DEMOCRACY	24	125
TFL ENTERPRISE	49	177
TFL FREEDOM	10	
TFL INDEPENDENCE	16	93
TFL ITALY	100	
TFL JEFFERSON	2	
TFL LIBERTY	33	139
THOMAS G. THOMPSON	181	195
THOMAS WASHINGTON	36	138
THOMPSON LYKES	4	89
THOMPSON PASS	38	69
TOHBEI MARU	133	52
TOKYO MARU	82	
TOKYO RAINBOW	49	23
TONCI TOPIC	1	43
TONSONIA	86	191
TOWER BRIDGE	81	
TOYOTA MARU NO 17	22	
TOYOTA MARU NO 18	1	
TRAVE ORE	15	24
TRI HEXAGON		67
TROPIC SUN	4	
TROPICAL BEAUTY	14	13
TROPICALE	72	38
TULSIDAS	63	116
ULTRAMAR	24	70
ULTRASEA	15	31
UNITED HOPE	28	94
UNITED SPIRIT	36	42
UNIVERSE	9	
USCGC ACACIA (WLB406)	10	11
USCGC ACTIVE WMEC 618	4	29
USCGC ALERT (WMEC 630)	20	
USCGC BASSWOOD (WLB 38	64	90
USCGC BISCAYNE BAY	1	4
USCGC BLACKHAW (WLB 39	52	
USCGC BOUTWELL WHEC 71	68	12
USCGC CHASE (WHEC 718)	2	51
USCGC CHEROKEE WMEC 16	27	93
USCGC CLOVER (WMEC 292	36	
USCGC DEPENDABLE	9	
USCGC EAGLE (WIX 327)	57	
USCGC HARRIET LANE	8	
USCGC INGHAM (WHEC 35)	2	
USCGC IRONWOOD (WLB 29	26	
USCGC JARVIS (WHEC 725	133	
USCGC KATMAI BAY	31	69
USCGC MACKINAW	10	10
USCGC MALLOW (WLB 396)	40	34
USCGC MESQUITE (WLB 30	3	
USCGC MORGENTHAU	17	
USCGC NORTHWIND WAGB 2	244	288
USCGC PLANETREE WLB 30	28	
USCGC POLAR SEA WAGB 1	1	37
USCGC POLAR STAR WAGB	95	81
USCGC RESOLUTE WMEC 62	2	
USCGC RUSH (WHEC 723)		9
USCGC SALVIA (WLB 400)	26	
USCGC SEDGE (WLB 402)	3	
USCGC STEADFAST WMEC 6	2	
USCGC STORIS (WMEC 38)	7	
USCGC SUNDEW (WLB 404)	2	
USCGC SWEETBRIER WLB 4	77	79
USCGC TAMAROA (WMEC 16	23	
USCGC TAMPA WMEC 902	18	
USCGC UNIMAK (WTR 379)	20	
USCGC UTE	1	5
USCGC VALIANT (WMEC 62	7	11
USCGC VIGILANT WMEC 61	6	12
USCGC WOODRUSH (WLB 40	28	
USCGC YOCONA (WMEC 168	141	208
USNS ALGOL	15	
USNS APACHE (T-ATF 172	24	33
USNS BARTLETT(T-AGOR 1	83	153
USNS BELLATRIX	1	
USNS CAPELLA	13	
USNS CATAWABA		31
USNS DE STEIGUER	2	
USNS GUS W. DARNELL	49	
USNS INVISIBLE		39
USNS JOHN LENTHAU		41
USNS MERCURY	35	22
USNS MISPILLION		44
USNS MISSISSINEWA		86
USNS MOHAWK (T-ATF 170	41	91
USNS NARRAGANSETT	8	111
USNS NAVAJO	71	36
USNS NEOSHO (T-AO 143)		125
USNS PASSUMPSIC TAO 10		50
USNS PAWCATUCK TAO-108		156
USNS POLLUX	10	53
USNS RANGE SENTINEL		10
USNS REDSTONE	18	
USNS RIGEL (T-AF 58)		85
USNS SEALIFT ANTARCTIC	55	44
USNS SEALIFT ARCTIC	25	162
USNS SEALIFT CHINA SEA	40	64
USNS SEALIFT IND'N OCE	17	50
USNS SEALIFT MED	25	37
USNS SEALIFT PACIFIC	28	56
USNS SILAS BENT T-AGS	138	196
USNS SPICA (T-AFS 9)		56
USNS VANGUARD TAG 194	67	176
USNS WACCAMAW(TAO-109)		77
USNSCC T/V 4731		18
VALLEY FORGE	2	61
VICTORY ACE	19	
VISHVA BHAKTI	5	
VISHVA PANKAJ	8	
VISHVA PAROG	4	
VISHVA PRAFULLA	3	97
VISHVA SIDDHI	6	
VISHVA TIRTH	1	
WASHINGTON HIGHWAY	56	33
WASHINGTON RAINBOW #2	44	32
WASHINGTON TRADER	8	22
WELLINGTON STAR	138	
WESER EXPRESS	11	
WESTERN PROGRESS		47
WESTERN SUN	20	20
WESTOCEAN	484	
WESTWARD VENTURE	62	29
WESTWOOD ANNETTE	30	235
WESTWOOD JAGO	10	42
WESTWOOD MARIANNE	17	14
WESTWOOD MERCHANT		116
WESTWOOD MERIT	9	
WESTWOOD MUSKETEER	3	
WILFRED SYKES	177	164
WILLIAM J. DELANCEY		337
WILLIAM R. ROESCH		69
WILLOWBANK	85	
WINTER STAR	20	
WINTER SUN	33	135
WORLD WING #2	134	
YAMASHIN MARU	135	31
YOUNG SCOPE	74	
YOUNG SKIPPER	12	16
YOUNG SOLDIER	36	17
YOUNG SPORTSMAN	25	16
YOUNG SPROUT	80	105
YS ARGOSY	63	103
ZAPATA ARCTIC	42	
ZAPATA COURIER	9	
ZEELANDIA	33	
ZEYNEP-K	1	
ZIM GENOVA	17	
ZIM HAIFA	28	
ZIM HONGKONG	68	
ZIM HOUSTON	33	
ZIM IBERIA	21	
ZIM KEELUNG	35	
ZIM MARSEILLES	18	
ZIM MIAMI	25	
ZIM NEW YORK	33	
ZIM SAVANNAH	27	
ZIM TOKYO	32	
ZOELLA LYKES	11	71

SUMMARY: GRAND TOTAL VIA RADIO 43018

GRAND TOTAL VIA MAIL 59468

TOTAL UNIQUE OBS 82259

TOTAL DUPLICATES 20227 (24.6%)

UNIQUE RADIO OBS.22791 (27.7%)

UNIQUE MAIL OBS. 39241 (47.7%)

Top Ship Radio: **Westocean**
Top Ship Mail: **NOAA Researcher**

Bathy-Tesac Data Received at NMC

July, August and September 1987

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
A8VI	17	17	0	PACDUCHESS
CBAK	3	3	0	***
CGBV	36	0	36	DAWSON
CGDG	194	5	189	HUDSON
CGDV	60	60	0	W. TEMPLEMAN
CG2683	380	380	0	ALFRED NEEDLER
CG2958	4	4	0	TULLY
CG2965	4	4	0	RICKER
CSBL	9	9	0	DAMIAO DE GOIS
CSHIP	10	10	0	***
CS1	52	52	0	***
CS2	14	14	0	***
C6CV9	56	56	0	***
C7C	244	0	244	OCEAN STATION CHARLIE
C7L	111	111	0	OCEAN STATION LIMA
DBBX	159	159	0	GAUSS
DBFJ	7	7	0	FRITHJOF
DBFP	63	63	0	WALTHER HERWIG
DCH	8	8	0	ELBE 1
DESI	25	25	0	VALDIVIA
DGFR	57	57	0	MONTE OLIVIA
DGLM	59	59	0	MONTE ROSA
DGSR	80	80	0	MONTE SARMIENTO
DGUK	1	1	0	***
DGVK	106	106	0	COLUMBIA VICTORIA
DGZV	76	76	0	COLUMBUS VIRGINIA
DHCW	53	53	0	COLUMBUS WELLINGTON
DHOU	3	3	0	***
DLEZ	9	9	0	***
DZLI	9	9	0	***
D5BC	3	3	0	SEDCO/BP471
D5ND	36	36	0	***
D5NE	37	37	0	MT. CABRITE
D5NZ	93	93	0	POLYNESIA
ELDN8	31	31	0	SEAL ISLAND
ELDW8	116	116	0	SKRIM
ELED8	22	22	0	PACPRINCESS
EREA	113	94	19	MONSOON
EREB	140	126	14	VOLNA
EREC	44	2	42	PRYLYV
EREI	69	4	65	OCEAN
ERES	29	29	0	VICTOR BUGAEN
ERET	106	101	5	GEORGE OUSHAKOV
EREU	108	105	3	ERNST KRENKEL
FALJ	1	1	0	***
FAQV	1	1	0	***
FNBF	43	43	0	ROSTAND
FNCW	62	62	0	ROUSSEAU
FNDL	1	1	0	***
FNDS	7	7	0	***
FNDT	52	52	0	***
FNDU	36	36	0	ZAMBEZE
FNDZ	15	15	0	ZELANDE
FNET	4	4	0	***
FNFB	1	1	0	***
FNFD	6	6	0	***
FNFG	4	4	0	***
FNGB	19	19	0	***
FNGS	51	51	0	LAFAYETTE
FNMZ	41	41	0	CORIOLIS
FNOM	62	62	0	ANGO
FNPA	46	46	0	***
FNQB	41	41	0	***
FNQL	1	1	0	***
FNQT	4	4	0	***
FNXE	3	3	0	***
FTQN	4	4	0	***
GACA	27	27	0	***
GNAM	8	8	0	CIROLANA
GOVL	3	3	0	ACT 4
GPHH	88	88	0	FARNELLA
GXYY	51	51	0	***
GYRW	33	33	0	ENCOUNTER BAY
HCGT	5	5	0	BUCCANEER
HLFX	1	1	0	PACBART
HPAN	24	24	0	MICRONESIAN COMMERCE
HPEW	61	61	0	PACIFIC ISLANDER
HBDY	82	82	0	CAP ANAMUR
H9BQ	54	54	0	MICRONESIAN INDEPENDENCE
JARV	1	1	0	***
JASQ	46	46	0	HIYOSHI MARU
JAWD	17	17	0	AMBASSADOR BRIDGE
JBES	122	122	0	YAMASHIN MARU
JBMS	54	54	0	HIKAWA MARU
JBOA	43	43	0	KEIFU MARU
JBRR	9	9	0	JAPAN TUNA 2
JCDF	18	18	0	SOYO MARU
JCDT	35	35	0	AMERICA MARU
JCIN	33	33	0	TOKYO MARU
JCOD	36	36	0	SHOYU MARU
JFDG	108	108	0	SHUMPU MARU
JGZK	62	62	0	RYOFU MARU
JIOW	36	36	0	ALASKA MARU
JJZC	60	60	0	HAKONE MARU
JNQK	59	59	0	***
JPEH	1	1	0	***
JPVB	136	136	0	SEIFU MARU
JQXW	16	16	0	HIERU MARU
JRPG	6	6	0	KAIYOU
KDBG	42	42	0	PRESIDENT LINCOLN
KGWT	35	35	0	THOMPSON, T.G.
KGWU	75	75	0	WASHINGTON, T.
KIYO	36	36	0	EXXON JAMESTOWN
KNBD	52	52	0	DELAWARE II
NAEE	1	1	0	USNS DE STEIGUER
NAQD	129	129	0	JARVIS

Bathy-tesac Data Received at NMC cont'd

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
NAVOC	1	1	0	***
NBTM	21	21	0	CGC POLAR STAR
NDRO	1	1	0	***
NDWA	25	25	0	MORGENTHAU
NENC	18	18	0	USNS SEALIFT PACIFIC
NHTE	20	20	0	ELROD
NHWR	12	12	0	MIDGETT
NIKL	19	19	0	TAMPA
NLGF	18	18	0	***
NLVS	5	5	0	RUSH
NNMU	1	1	0	***
NOHW	5	5	0	***
NQST	59	59	0	***
NRCB	24	24	0	EAGLE
NRFJ	75	75	0	CGC NORTHWIND
NRUO	15	15	0	POLAR SEA
NYCQ	70	70	0	CGC BOUTWELL
NZOC	1	1	0	***
OFXB	58	58	0	***
OWEQ	12	12	0	MC KINNEY MAERSK
OXMD	45	45	0	LARS MAERSK
OXYL	31	31	0	BAMSA DAN
OYBG	29	29	0	FALSTRIA
PACM	25	25	0	PACIFIC MISSILE RANGE
PGDF	27	27	0	NEDLLOYD KATWIJK
PGDG	54	54	0	NEDLLOYD KINGSTON
PGDS	27	27	0	NEDLLOYD KYOTO
PGOF	41	41	0	NEDLLOYD KEMBLA
PJYG	40	40	0	OLEANDER
PLAT	202	202	0	PLATFORM
PWGA	4	4	0	***
PWSA	6	6	0	***
SCOR	7	7	0	***
SCOV	1	1	0	TV 244
SCOW	1	1	0	***
SCPE	8	8	0	TV 253
SCPF	1	1	0	***
SCPH	1	1	0	***
SCPI	8	8	0	***
SCPK	3	3	0	TV 260
SCQG	4	4	0	***
SEPI	21	0	21	***
SEXN	10	10	0	TV 227
SEXQ	5	5	0	TV 278
SEXU	1	1	0	TV 04
SGQJ	56	56	0	ELGAREN
SHPF	3	3	0	TV 281
SKVP	12	12	0	***
SKVQ	2	2	0	***
SLDN	1	1	0	***
SLRI	1	1	0	***
SMZJ	6	6	0	TV 105
SMZP	1	1	0	TV 101
SMZQ	3	3	0	TV 102

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
SPEW	4	4	0	***
TEST	5	5	0	***
TESTP	1	1	0	***
TFJA	31	31	0	ARNI FRIDRIKSSON
TFXQ	15	15	0	RAKKAFOSS
UAAX	18	0	18	VOYKOV
UBNZ	13	13	0	SHULEYKIN AKADEMIK
UCOP	1	1	0	***
UEAK	51	8	43	VALERIAN URYVAYEV
UFJJ	5	5	0	***
UFYN	66	5	61	***
UHQS	57	3	54	ACADEMIC KOROLEV
UJFO	107	101	6	MULTANOVSKIY PROF
UJFY	1	0	1	***
UJLN	1	1	0	***
UJOB	5	5	0	***
UKGF	2	2	0	***
UMAY	68	8	60	ACADEMIC SHIRSHOV
UMFW	142	142	0	PROF. ZUBOV
UPUI	135	124	11	PROFESSOR VIZE
UQHM	31	5	26	***
URJP	1	1	0	***
URYM	23	0	23	RUDOLF SAMOILOVICH
URYR	1	1	0	***
URYX	1	1	0	***
USOP	1	1	0	NIKOLAI KONONOV
UTSZ	44	0	44	***
UUPB	14	6	8	AKADEMIK N. SHOKALSKIY
UUQR	9	9	0	MOLOHANOV PAVEL PRO
UUZH	1	1	0	***
UVMJ	7	7	0	VSEVOLOD BERYOZKIN
UVMM	149	129	20	YAKOV GAKKEL
UWEC	16	15	1	KHROMOV PROFESSOR
UZDV	2	2	0	***
UZGH	109	106	3	PASSAT
UZWK	1	1	0	***
VCBT	2	2	0	CAPE ROGER
VCTF	13	13	0	CAPE BRIER
VC805	3	3	0	***
VC945	158	158	0	GADUS ATLANTICA
VJBQ	19	19	0	ANRO AUSTRALIA
VKCN	159	159	0	CANBERRA
VKCV	123	123	0	DERWENT
VKDA	81	81	0	***
VKLA	45	45	0	ADELAIDE
VKLB	49	49	0	HOBART
VKMK	39	39	0	***
VKML	4	4	0	SNIPE
VKMN	13	13	0	TEALE
VKMS	278	278	0	COOK
VLNB	94	94	0	TORRENS
VMAP	215	215	0	AUSTRALIAN PROGRESS
VPGE	34	34	0	***
VP47	53	53	0	AIRCRAFT

Bathy-tesac Data Received at NMC cont'd

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
VP49	128	128	0	AIRCRAFT
VP56	94	94	0	AIRCRAFT
VXN8	191	191	0	AIRCRAFT
WA211	128	128	0	ALASKA
WCGN	10	10	0	CHEVRON CALIFORNIA
WDAG	43	43	0	SHENAHON
WECB	107	107	0	MELVILLE
WHBA	127	127	0	R.D.CONRAD
WI711	41	41	0	***
WMVC	7	7	0	J.N.COBB
WMVF	154	154	0	ALBATROSS IV
WNJG	12	12	0	SENATOR
WRB22	28	28	0	***
WSC22	9	9	0	POINT SUR
WSE3385	106	106	0	GLORITA
WTDF	76	76	0	T. CROMWELL
WTDK	227	227	0	C.S. JORDAN
WTDM	16	16	0	M.FREEMAN
WTDO	75	72	3	OREGON II
WTEA	59	59	0	DISCOVERER
WTEB	19	19	0	FAIRWEATHER
WTED	115	115	0	CHAPMAN
WTEF	16	16	0	RAINIER
WTEJ	248	248	0	MC ARTHUR
WTEK	29	29	0	DAVIDSON
WTEP	158	158	0	OCEANOGRAPHER
WTER	208	208	0	RESEARCHER
WTES	31	31	0	SURVEYOR
WTEW	1	1	0	WHITING
WTEZ	3	3	0	FERREL
WXBR	59	59	0	CHEVRON MISSISSIPPI
WXQ7334	21	21	0	PETER ANDERSON
WYR44	33	33	0	***
WYR7512	52	52	0	BALD EAGLE
WYR9891	12	12	0	SEA HAVEN
WYV65	64	64	0	***
WZE3929	40	40	0	MOANA WAVE
XXXX	940	920	20	NO SHIP CALL SIGN REC'D
Y3CH	13	0	13	PROF. ALBRECHT PENCK
ZCSK	19	19	0	***
ZMCR	32	32	0	***
ZMHD	7	7	0	***
3EIX2	33	33	0	PRESENTE IBA
3FHI2	128	128	0	MOANA PACIFIC
5LFX	25	25	0	PACBARONESS
5MCB	14	14	0	PACMERCHANT
7JOB	33	33	0	SHINKASHU MARU
7KDD	5	5	0	YOKO MARU
8JIF	14	14	0	SHUMYO MARU
8JNZ	181	181	0	KOFU MARU
9VUU	42	42	0	CHIEH SHENG

TOTAL BATHYS RECEIVED 11913
TOTAL TESACS RECEIVED 1053
TOTAL REPORTS RECEIVED 12966

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U. S. NDBC Climatological Data

July, August and September 1987

JUL 1987

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN WAVE HT (M)	MAX WAVE HT (M)	MAX WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
32302	18.0S	085.1W	745	18.8	20.3	2.0	5.6	26/19	9.6	SE	21.4	19/11	1016.0
41002	32.2N	075.3W	743	27.5	28.2	1.1	2.0	17/21	9.2	SW	21.1	16/18	1019.3
41006	29.3N	077.4W	744	28.0	29.0	0.9	2.1	19/14	8.1	SW	25.7	17/17	1017.9
42001	25.9N	089.7W	248	28.8	29.8	0.5	1.3	20/09	7.6	E	22.8	25/15	1016.6
42002	26.0N	093.5W	742	28.6	29.7	0.8	1.9	09/11	9.1	SE	24.5	08/05	1016.3
42003	26.0N	085.9W	741	29.0	29.8	0.7	1.6	19/23	6.5	E	21.2	19/22	1017.6
42007	30.1N	088.9W	744	28.5	28.9	0.3	1.7	26/10	7.8	SW	21.8	29/02	1016.9
42015	30.2N	088.2W	577	28.2	29.2				6.9	SW	23.3	01/22	1017.0
44004	38.5N	070.6W	272	23.5	23.5	1.1	2.1	03/18	9.9	SW	18.6	05/09	1016.9
44005	42.7N	068.3W	744	16.5	15.9	0.7	1.9	01/00	7.1	S	19.2	21/08	1015.4
44007	43.5N	070.1W	743	17.2	15.4	0.5	1.2	03/17	0.5	NE	17.5	30/21	1014.8
44008	40.5N	069.5W	741	16.7	14.3	0.7	1.8	05/05	6.8	SW	19.4	26/10	1015.7
44009	38.5N	074.6W	743	23.5	23.0	0.6	1.4	03/14	9.1	SW	23.3	03/04	1017.0
44011	41.1N	066.6W	693	16.1	15.1	0.9	1.7	05/03	6.3	SW	16.3	01/03	1016.0
44012	38.8N	074.6W	699	23.3	22.6	0.6	1.3	03/04	8.6	SW	25.3	15/04	1017.0
44013	42.4N	070.8W	744	19.7	18.0	0.3	1.0	03/08	4.9	N	17.5	03/04	1015.5
45001	48.0N	087.7W	743	13.3	9.9	0.4	1.5	17/15	9.0	SE	18.2	09/20	1015.6
45002	45.3N	086.4W	743	19.5	19.1	0.6	2.2	17/19	7.9	SW	25.3	09/12	1014.5
45003	45.3N	082.8W	714	18.3	17.7	0.4	1.9	14/04	6.8	S	21.4	14/00	1014.9
45004	47.6N	086.5W	741	12.5	10.4	0.4	1.6	17/12	7.0	SE	19.4	19/06	1014.3
45005	41.7N	082.4W	743	23.6	24.2	0.3	1.5	14/09	7.5	SW	23.3	14/08	1016.4
45006	47.3N	089.8W	744	15.5	13.9	0.3	2.0	18/22	6.2	SW	27.2	18/00	1013.7
45007	42.7N	087.1W	744	21.5	21.3	0.4	2.7	15/20	7.9	S	31.1	15/20	1015.0
45008	44.3N	082.4W	732	20.0	19.6	0.4	1.3	04/10	7.7	N	21.4	14/01	1015.4
46001	56.3N	148.3W	742	10.2	10.8	1.4	3.5	16/14	9.7	SW	23.5	16/10	1017.0
46002	42.5N	130.4W	744	14.5	15.3	1.8	4.1	18/16	10.6	N	22.6	17/03	1018.9
46003	51.9N	155.9W	742	8.7	7.9	1.7	4.2	16/07	11.2	W	26.8	15/18	1019.3
46004	50.9N	135.9W	742	11.2	11.4	1.6	3.1	19/13	10.1	NW	22.1	18/14	1019.0
46005	46.1N	131.0W	260	13.7	14.5	1.1	1.7	21/04	7.0	W	16.2	27/22	1016.2
46006	40.8N	137.6W	743	14.4	15.8	1.7	3.7	19/03	11.4	N	23.8	19/17	1023.9
46010	46.2N	124.2W	738	13.7	13.3	1.3	3.1	15/13	6.1	N	23.3	14/02	1016.4
46011	34.9N	120.9W	743	14.0	13.9	1.5	3.4	08/10	12.1	NW	26.6	08/09	1013.4
46012	37.4N	122.7W	740	13.5	14.0	1.5	4.3	17/05	7.7	NW	29.1	17/09	1014.7
46013	38.2N	123.3W	742	12.7		1.7	5.1	17/02	13.9	W	34.1	09/03	1014.4
46014	39.2N	124.0W	738	13.3	12.8	1.8	4.7	16/23	11.4	NW	31.9	17/00	1014.8
46016	63.3N	170.3W	248	8.1					0.0	N			1013.6
46022	40.7N	124.5W	743	13.1	12.4	1.6	4.9	16/08	7.8	N	22.1	16/19	1016.4
46023	34.3N	120.7W	744	14.5	14.6	1.8	3.5	09/19	14.4	NW	28.8	08/10	1013.1
46025	33.7N	119.1W	743	17.4	19.0	0.8	1.4	04/07	5.3	W	15.7	21/03	1012.7
46026	37.8N	122.7W	301	13.0	13.0	1.5	3.3	09/03	10.8	W	27.6	08/08	1014.3
46027	41.8N	124.4W	742	12.4	11.1	1.6	4.6	15/21	9.0	NW	44.7	16/00	1016.4
46028	35.8N	121.9W	741	14.6	14.5	2.0	4.2	09/11	13.8	NW	28.0	31/06	1014.6
46036	48.3N	133.9W	742	12.0	13.2	1.6	4.0	18/16	9.9	NW	22.6	18/16	1019.6
46039	48.2N	123.4W	737	11.9	10.8	0.4	1.7	15/01	10.5	W	31.1	15/03	1014.8
46040	44.8N	124.3W	744	13.5	13.5	1.5	3.4	15/12	7.4	N	19.4	04/17	1016.8
46041	47.4N	124.5W	742	12.9	13.1	1.3	3.1	16/08	7.1	NW	21.4	04/21	1015.8
46042	36.8N	122.2W	728	13.6	13.8				11.0	NW	25.3	07/23	1013.8
46043	46.9N	124.2W	743	13.0	12.7				0.0	N			1016.2
51001	23.4N	162.3W	744	25.3	25.4	1.8	2.7	21/04	12.6	E	19.7	07/03	1017.4
51002	17.2N	157.8W	742	26.1	26.6	1.9	3.1	31/08	13.7	E	20.4	30/19	1013.9
51003	19.2N	160.8W	744	26.2	27.0	1.7	2.6	04/09	9.8	NE	19.6	03/20	1014.5
51004	17.5N	152.6W	742	25.6	26.5	2.1	3.2	21/00	13.2	E	21.0	21/07	1014.3
51005	20.4N	156.1W	743	24.9	25.5	1.7	2.6	20/10	17.1	E	27.2	04/05	1015.9
ALRF1	24.9N	080.6W	697	28.5	29.5				10.3	E	39.1	29/03	1017.4
ALSN6	40.5N	073.8W	744	22.9	21.3				9.8	SW	24.0	14/21	1017.3
BURL1	28.9N	089.4W	743	28.5					7.7	E	24.0	01/08	1017.6
BUZM3	41.4N	071.0W	741	19.3					10.2	S	24.0	18/22	1016.4
CARO3	43.3N	124.4W	744	12.9					6.3	N	29.0	18/22	1017.3
CHLV2	36.9N	075.7W	744	25.4	25.2				9.4	SW	26.0	26/23	1017.1
CLKN7	34.6N	076.5W	726	26.7					8.7	SW	21.0	15/23	1017.8
CSBF1	29.7N	085.4W	532	28.5					5.2	W	15.0	14/11	1017.0
DBLN6	42.5N	079.4W	744	23.0					8.1	SW	28.0	20/09	1015.7
DESW1	47.7N	124.5W	743	12.8					8.2	NW	30.0	17/00	1015.9
DISW3	47.1N	090.7W	743	18.7					8.1	NE	32.0	18/23	1012.8
DPIA1	30.3N	088.1W	743	28.1	29.6				7.7	SW	30.9	24/21	1017.0
DSLN7	35.2N	075.3W	743	26.7	27.5				11.0	SW	32.0	15/22	
FBIS1	32.7N	079.9W	744	27.2					7.7	SW	21.0	17/20	1017.8
FFIA2	57.3N	133.6W	404	12.9					6.0	N	30.0	14/12	1013.3

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July, August and September 1987

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN WAVE HT (M)	MAX WAVE HT (M)	MAX WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
FPSN7	33.5N	077.6W	744	27.0	29.3				11.4	SW	30.0	29/11	1017.4
GDIL1	29.3N	090.0W	742	28.3	30.3				6.2	E	30.0	01/20	1017.1
GLLN6	43.9N	076.4W	716	21.9					9.2	W	28.0	27/21	1015.1
IOSN3	43.0N	070.6W	743	19.0					9.7	S	23.0	26/17	1015.9
LKWF1	26.6N	080.0W	744	27.9	28.9				7.5	SE	23.0	19/15	1018.1
MDRM1	44.0N	068.1W	744	15.0					9.9	S	24.0	28/03	1015.8
MISM1	43.8N	068.9W	743	15.2					11.0	S	26.0	21/09	1014.9
NWPO3	44.6N	124.1W	744	12.9					7.8	S	28.0	14/23	1016.4
PILM4	48.2N	088.4W	744	14.8					9.4	S	28.0	17/06	1013.5
PTAC1	39.0N	123.7W	743	12.3					10.3	N	27.0	16/22	1014.2
PTAT2	27.8N	097.1W	744	28.1					11.4	SE	24.0	17/02	1015.6
PTGC1	34.6N	120.7W	744	13.9					15.0	N	30.0	05/06	1013.4
ROAM4	47.9N	089.3W	744	15.9					11.4	SW	31.0	16/19	1013.2
SAUF1	29.9N	081.3W	744	26.7					6.9	SW	25.1	30/02	1018.5
SBIO1	41.6N	082.8W	703	24.0					7.5	SW	30.0	09/23	1015.7
SGNW3	43.8N	087.7W	744	20.3	16.4				8.3	S	23.0	11/22	1015.0
SISW1	48.3N	122.8W	716	13.1					7.9	W	30.0	16/02	1013.7
SPGF1	26.7N	079.0W	740	28.1	29.5				3.8	SE	21.0	14/00	
SRST2	29.7N	094.1W	742	27.9					7.9	S	30.0	07/20	1016.5
STDM4	47.2N	087.2W	744	16.9					12.6	S	32.0	17/01	1014.2
SVLS1	32.0N	080.7W	674	27.4	28.5				10.7	SW	32.0	12/22	1018.6
TPLM2	38.9N	076.4W	743	26.3	26.6				7.3	S	27.0	28/05	1016.6
TTIW1	48.4N	124.7W	744	12.6					7.5	SW	24.0	19/14	1016.0
VENF1	27.1N	082.5W	733	27.2	30.6				5.8	E	18.0	14/11	1018.5
WPOW1	47.7N	122.4W	743	14.7					6.1	NE	18.0	22/12	1014.6
AUGUST		1987											
32302	18.0S	085.1W	738	18.3	19.7	2.3	4.1	28/19	11.9	SE	23.3	28/15	1017.3
41001	34.9N	072.9W	240	26.0	27.2	1.0	2.4	23/17	10.2	SW	21.5	23/16	1019.9
41002	32.2N	075.3W	744	27.7	28.2	1.2	2.5	14/08	9.2	SW	22.1	13/09	1017.5
41006	29.3N	077.4W	744	28.4	29.3	1.0	2.1	14/17	7.0	SW	20.5	13/21	1017.7
42001	25.9N	089.7W	248	29.3	30.5	0.4	1.7	09/09	6.2	E	18.4	08/15	1016.2
42002	26.0N	093.5W	744	29.0	30.0	0.6	2.4	09/11	8.4	SE	24.6	09/04	1016.0
42003	26.0N	085.9W	743	29.5	30.4	0.5	1.4	09/03	5.6	NE	22.5	07/22	1017.5
42007	30.1N	088.9W	743	28.7	29.1	0.2	1.1	12/17	8.4	W	26.2	12/16	1015.8
42015	30.1N	088.2W	743	28.2	29.0				7.2	SW	21.4	12/13	1016.2
44004	38.5N	070.6W	743	23.5	24.4	1.2	3.0	14/12	4.9	N	18.6	10/11	1017.5
44005	42.7N	068.3W	743	17.9	18.0	1.0	2.7	23/00	9.2	SW	22.9	22/23	1015.9
44007	43.5N	070.1W	744	17.4	15.9	0.6	2.2	22/21	8.4	S	27.2	22/20	1015.4
44008	40.5N	069.5W	742	18.2	17.5	0.9	2.2	23/08	7.8	SW	21.4	24/05	1016.3
44009	38.5N	074.6W	740	23.8	24.1	0.8	2.0	15/05	10.0	SW	23.3	10/05	1017.4
44011	41.1N	066.6W	744	17.2	16.7	1.1	2.7	30/11	7.2	SW	19.7	23/08	1016.2
44012	38.8N	074.6W	700	23.4	23.5	0.8	1.8	06/16	9.2	S	25.3	23/12	1017.8
44013	42.4N	070.8W	508	20.2	18.7	0.4	1.4	13/16	0.0	N			1015.3
45001	48.0N	087.7W	743	15.8	14.6	0.6	2.2	18/00	9.6	SW	26.8	03/11	1015.7
45002	45.3N	086.4W	741	19.9	20.8	0.8	2.2	22/11	10.8	SW	29.1	02/03	1015.0
45003	45.3N	082.8W	743	18.7	19.4	0.7	2.5	22/15	10.1	NW	27.2	16/17	1015.1
45004	47.6N	086.5W	734	15.8	15.2	0.7	2.5	30/21	9.0	S	29.1	22/08	1014.4
45005	41.7N	082.4W	743	22.2	23.7	0.5	1.6	28/13	10.0	S	25.3	03/00	1016.5
45006	47.3N	089.8W	404	17.7	16.8	0.4	1.5	03/23	7.4	SW	19.4	17/13	1011.3
45007	42.7N	087.1W	744	21.3	22.1	0.6	2.8	05/02	9.6	S	23.3	05/01	1017.0
45008	44.3N	082.4W	744	19.7	20.5	0.8	2.9	22/18	11.5	S	27.2	18/22	1015.8
46001	56.3N	148.3W	743	12.5	13.3	1.6	3.9	25/00	11.5	SW	24.7	23/00	1020.9
46002	42.5N	130.4W	743	15.6	16.5	1.9	4.0	08/23	13.1	N	21.7	08/13	1023.1
46003	51.9N	155.9W	743	11.2	10.6	1.7	5.1	05/14	11.2	SW	24.1	04/22	1021.0
46004	50.9N	135.9W	744	13.7	13.6	1.7	3.6	13/13	12.1	NW	22.6	13/14	1023.3
46005	46.1N	131.0W	741	15.0	15.5	1.7	4.1	09/05	11.2	NW	23.5	09/10	1023.9
46006	40.8N	137.6W	742	16.1	16.8	1.5	3.0	23/23	12.0	NE	24.2	23/16	1026.2
46010	46.2N	124.2W	744	13.4	12.4	1.3	3.0	09/11	6.0	N	23.3	02/06	1019.3
46011	34.9N	120.9W	743	14.9	15.4	1.3	2.1	07/09	7.0	NW	17.0	24/06	1015.0
46012	37.4N	122.7W	739	14.2	15.0	1.3	2.2	25/09	4.2	S	15.5	01/00	1015.2
46013	38.2N	123.3W	744	13.2	13.8	1.6	3.0	07/07	5.8	NW	26.6	14/06	1015.5
46014	39.2N	124.0W	669	12.7	12.8	1.8	3.6	07/03	7.0	NW	23.4	01/04	1014.7
46016	63.3N	170.3W	247	9.2					0.0	N			1017.0
46022	40.7N	124.5W	741	12.4	12.2	1.9	4.0	07/05	8.6	N	20.1	13/09	1016.3
46023	34.3N	120.7W	744	15.2	15.7	1.4	2.6	08/16	10.8	NW	22.4	05/08	1014.5
46025	33.7N	119.1W	634	18.4	20.4	0.9	1.7	23/07	5.3	W	16.6	23/03	1013.9
46027	41.8N	124.4W	496	11.9	10.5	2.2	3.5	07/00	13.4	N	36.9	06/02	1014.9
46028	35.8N	121.9W	741	15.5	16.1	1.7	2.8	01/03	5.8	NW	19.1	01/02	1015.6
46035	57.0N	177.7W	112	8.8	9.6	1.8	4.5	30/15	15.3	SE	32.4	30/14	1015.0

U.S. NDBC Climatological Data cont'd

July, August and September 1987

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN WAVE HT (M)	MAX WAVE HT (M)	MAX WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
46036	48.3N	133.9W	744	14.3	14.8	1.7	3.7	10/19	11.0	NW	20.8	13/20	1025.2
46039	48.2N	123.4W	739	12.3	11.1	0.5	1.9	04/21	9.9	W	31.1	04/22	1018.2
46040	44.8N	124.3W	743	12.3	11.2	1.6	3.5	08/23	8.6	N	21.4	19/03	1019.2
46041	47.4N	124.5W	743	12.7	12.4	1.3	2.8	09/02	6.4	NW	19.4	19/00	1019.1
46042	36.8N	122.2W	239	13.8	14.5				5.0	NW	19.4	01/01	1012.2
46043	46.9N	124.2W	744	12.4	11.3				0.0	N			1019.3
51001	23.4N	162.3W	743	26.6	27.2	1.7	2.8	12/15	9.8	E	23.1	12/14	1016.2
51002	17.2N	157.8W	743	26.7	27.2	2.1	3.5	28/04	13.5	E	21.5	27/19	1013.3
51003	19.2N	160.8W	742	27.0	27.9	1.8	3.2	29/00	8.4	E	16.6	02/18	1013.6
51004	17.5N	152.6W	743	26.0	26.9	2.0	3.1	21/20	13.0	E	22.9	02/11	1013.7
51005	20.4N	156.1W	742	25.8	26.8	1.6	2.5	12/10	15.5	E	21.4	01/15	1015.2
ALRF1	24.9N	080.6W	742	28.9	30.2				9.5	E	22.0	05/21	1016.7
ALSN6	40.5N	073.8W	744	21.9	22.3				11.1	SW	29.0	22/14	
BURL1	28.9N	089.4W	743	29.0					8.4	SW	24.0	11/15	1016.7
BUZM3	41.4N	071.0W	742	19.5					11.8	SW	30.0	22/20	1017.1
CARO3	43.3N	124.4W	742	11.3					7.9	NE	24.0	01/20	1019.0
CHLV2	36.9N	075.7W	742	25.3	25.6				10.3	SW	31.0	04/23	1017.0
CLKN7	34.6N	076.5W	722	26.6					10.4	SW	27.0	11/02	1017.1
CSBF1	29.7N	085.4W	742	28.5					5.4	SW	22.0	15/10	1016.4
DBLN6	42.5N	079.4W	742	20.7					9.1	SW	27.0	22/14	1016.1
DESW1	47.7N	124.5W	743	12.4					7.6	NW	28.0	23/00	1019.1
DISW3	47.1N	090.7W	744	18.6					10.3	SW	32.0	30/11	1014.2
DPIA1	30.3N	088.1W	743	28.2	29.7				7.4	W	26.5	19/04	1015.9
DSLN7	35.2N	075.3W	743	26.7	27.7				13.3	SW	30.0	15/05	1019.1
FBIS1	32.7N	079.9W	742	27.7					8.7	SW	24.0	30/09	1016.1
FFIA2	57.3N	133.6W	744	13.7					6.3	N	26.9	09/12	1020.5
FPSN7	33.5N	077.6W	743	27.2	30.5				12.5	SW	30.0	02/07	1016.6
GDIL1	29.3N	090.0W	744	28.9	30.5				6.3	SW	20.0	11/14	1016.3
GLLN6	43.9N	076.4W	715	20.3					11.1	W	27.0	23/21	1015.9
IOSN3	43.0N	070.6W	744	18.4					10.3	NW	28.0	03/11	1016.8
LKWF1	26.6N	080.0W	742	28.5	29.8				7.4	E	16.0	09/18	1017.3
MDRM1	44.0N	068.1W	744	15.0					11.2	SW	30.0	22/20	1015.3
MISM1	43.8N	068.9W	744	15.6					11.8	SW	32.0	22/20	1015.8
NWPO3	44.6N	124.1W	741	11.4					9.3	N	30.0	18/23	1018.5
PILM4	48.2N	088.4W	743	16.1					11.7	W	32.0	30/20	1013.8
PTAC1	39.0N	123.7W	744	12.3					6.9	N	23.0	14/13	1014.8
PTAT2	27.8N	097.1W	555	28.3					10.8	SE	22.0	12/08	1014.3
PTGC1	34.6N	120.7W	744	14.8					12.1	N	28.0	05/03	1014.7
ROAM4	47.9N	089.3W	743	16.6					12.9	W	36.1	01/18	1013.9
SAUF1	29.9N	081.3W	743	27.1					6.7	SW	19.6	20/21	1017.5
SBIO1	41.6N	082.8W	710	22.4					9.1	SW	26.0	18/03	1015.6
SGNW3	43.8N	087.7W	744	19.7	18.9				9.2	S	25.0	09/02	1015.6
SISW1	48.3N	122.8W	742	13.5					7.2	W	26.0	05/05	1016.9
SPGF1	26.7N	079.0W	520	28.8	30.0				5.6	SE	17.2	26/23	1019.3
SRST2	29.7N	094.1W	743	28.6					7.9	SW	22.0	10/05	1015.7
STDM4	47.2N	087.2W	744	17.4					13.5	S	38.1	22/05	1014.6
SVLS1	32.0N	080.7W	581	28.0	29.6				11.7	S	27.7	13/02	1017.8
TPLM2	38.9N	076.4W	742	24.6	26.3				8.3	N	23.0	11/00	1017.2
TTIW1	48.4N	124.7W	741	12.6					8.2	SW	32.0	09/19	1019.2
VENF1	27.1N	082.5W	735	27.9	31.0				6.2	E	26.0	21/23	1017.3
WPOW1	47.7N	122.4W	743	15.2					5.7	NE	16.0	05/00	1017.7
SEPTEMBER 1987													
32302	18.0S	085.1W	670	17.9	18.8	2.2	4.2	10/00	12.6	NW	25.3	10/07	1018.0
41001	34.9N	072.9W	682	25.7	27.3	1.4	3.5	06/14	11.4	E	29.9	19/05	1015.3
41002	32.2N	075.3W	681	27.0	27.9	1.2	3.1	06/06	8.8	SW	19.3	05/22	1016.0
41006	29.3N	077.4W	683	27.6	28.7	0.9	2.1	06/21	7.5	S	18.9	08/18	1015.7
42001	25.9N	089.7W	529	28.2	30.3	0.5	2.3	30/23	7.9	S	25.9	12/15	1015.0
42002	26.0N	093.5W	681	28.2	29.7	0.7	3.0	30/20	9.3	NE	24.9	30/15	1014.3
42003	26.0N	085.9W	682	28.8	30.4	0.4	1.6	30/22	5.8	E	22.2	30/19	1014.7
42007	30.1N	088.9W	683	25.7	27.8	0.3	1.2	05/01	8.6	SW	23.2	30/10	1014.5
42015	30.1N	088.2W	672	26.4	28.4	0.4	1.2	28/07	8.5	N	23.3	01/13	1014.8
44004	38.5N	070.6W	682	21.8	22.4	1.3	2.6	24/09	8.5	E	20.8	18/08	1017.2
44005	42.7N	068.3W	681	15.7	15.7	1.3	3.7	20/10	10.9	SW	25.3	26/01	1015.9
44006	36.2N	075.5W	402	23.3	23.9	0.7	1.6	20/18	9.1	SW	17.1	23/02	1014.8
44007	43.5N	070.1W	680	14.7	14.0	0.8	3.1	20/22	10.6	S	27.2	19/05	1015.5
44008	40.5N	069.5W	679	17.4	17.0	1.1	3.1	19/19	9.2	S	27.2	19/00	1016.0
44009	38.5N	074.6W	678	21.6	22.0	0.9	2.5	20/02	10.3	SW	23.3	01/06	1016.9
44011	41.1N	066.6W	681	15.9	15.2	1.3	3.3	20/06	8.7	SW	20.1	22/05	1016.4

U.S. NDBC Climatological Data cont'd

July, August and September 1987

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN WAVE HT (M)	MAX WAVE HT (M)	MAX WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
44012	38.8N	074.6W	632	21.2	21.6	0.8	2.5	20/01	10.2	E	23.3	19/23	1017.4
45001	48.0N	087.7W	682	14.3	14.0	0.7	1.8	19/20	9.6	W	18.9	25/21	1014.8
45002	45.3N	086.4W	677	16.7	18.1	0.7	2.3	17/23	10.4	SW	25.3	30/17	1014.0
45003	45.3N	082.8W	680	15.6	16.5	0.7	2.5	01/00	10.0	NW	25.3	17/19	1014.0
45004	47.6N	086.5W	672	14.2	14.5	0.7	2.4	30/16	9.8	N	23.3	30/13	1013.9
45005	41.7N	082.4W	681	18.9	20.4	0.3	2.0	30/22	8.5	S	31.1	30/22	1015.4
45006	47.3N	089.9W	378	14.0	13.8	0.6	1.8	17/17	9.6	NE	19.4	21/09	1013.8
45007	42.7N	087.1W	680	18.2	19.7	0.6	2.1	30/23	9.5	SE	25.3	30/03	1014.3
45008	44.3N	082.4W	681	17.0	18.1	0.7	2.3	01/02	10.7	S	23.3	01/01	1014.5
46001	56.3N	148.3W	681	11.2	12.3	2.6	6.2	23/00	13.6	SW	29.2	22/23	1005.7
46002	42.5N	130.4W	681	16.5	17.3	2.1	5.8	15/02	10.1	N	21.1	14/22	1020.6
46003	51.9N	155.9W	680	10.9	10.8	2.9	7.3	23/05	15.8	SW	31.2	21/22	1008.4
46004	50.9N	135.9W	679	13.4	13.9	2.1	6.8	14/19	12.6	W	34.6	14/17	1017.0
46005	46.1N	131.0W	681	15.4	16.0	2.3	6.7	14/18	11.9	N	27.1	14/12	1020.0
46006	40.8N	137.6W	679	17.1	17.8	2.1	5.4	14/20	7.3	N	25.0	19/13	1021.9
46010	46.2N	124.2W	681	13.6	13.0	1.6	4.6	16/01	0.0	N			1018.8
46011	34.9N	120.9W	677	14.9	15.6	1.5	3.6	16/09	10.7	NW	25.6	11/01	1015.2
46012	37.4N	122.7W	681	14.3	15.3	1.5	4.1	16/07	6.8	NE	17.5	15/23	1016.4
46013	38.2N	123.3W	680	13.5	13.7	1.7	4.8	16/00	10.5	W	30.8	26/01	1016.8
46014	39.2N	124.0W	680	12.9	13.4	1.7	5.2	15/19	9.3	NW	28.1	16/00	1016.4
46016	63.3N	170.3W	156	3.6					0.0	N			1003.6
46022	40.7N	124.5W	399	12.7	12.4	1.6	5.2	16/08	7.8	N	21.3	13/10	1017.5
46023	34.3N	120.7W	679	15.5	16.6	1.8	4.5	16/15	15.0	NW	27.0	10/11	1014.5
46027	41.8N	124.4W	518	12.0	11.5	1.7	4.7	16/03	7.4	N	33.0	16/01	1018.8
46028	35.8N	121.9W	679	15.5	16.0	1.9	4.9	16/19	11.8	NW	24.4	11/05	1016.2
46035	57.0N	177.7W	676	7.7	9.0	2.5	10.8	22/04	12.6	N	43.1	22/02	1007.8
46036	48.3N	133.9W	519	14.4	15.2	2.4	8.1	14/14	12.1	NW	28.5	14/11	1019.3
46039	48.2N	123.4W	679	12.1	11.0	0.4	1.4	02/00	7.7	W	27.2	02/19	1018.1
46040	44.8N	124.3W	681	12.6	12.2	1.9	6.5	15/09	5.9	N	21.4	14/17	1019.0
46041	47.4N	124.5W	676	12.6	12.6	1.6	4.6	15/03	5.4	NW	25.3	14/15	1018.5
46042	36.8N	122.2W	196	15.3	16.0	1.2	1.7	06/03	7.9	NW	21.4	11/00	1015.6
46043	46.9N	124.2W	675	12.7	12.0				0.0	N			1018.8
51001	23.4N	162.3W	680	26.5	27.0	2.0	3.7	25/05	12.9	E	21.6	30/05	1016.3
51002	17.2N	157.8W	681	27.0	27.7	1.9	3.4	16/15	11.4	E	21.8	18/17	1013.4
51003	19.2N	160.8W	681	27.2	28.2	1.9	3.1	23/13	8.8	E	22.1	04/18	1013.5
51004	17.5N	152.6W	678	26.3	27.1	1.9	3.2	26/11	11.7	E	20.9	15/00	1014.1
51005	20.4N	156.1W	679	26.2	27.5	1.5	2.8	12/02	14.4	NW	27.2	12/00	1015.1
ALRF1	24.9N	080.6W	580	28.7	30.3				6.8	E	21.0	15/00	1014.8
ALSN6	40.5N	073.8W	681	19.4	20.2				12.1	SW	35.1	18/19	1019.8
BURL1	28.9N	089.4W	681	27.0					8.9	N	28.0	11/23	1015.1
BUZM3	41.4N	071.0W	678	17.6					13.3	SW	37.1	19/18	1016.9
CARO3	43.3N	124.4W	681	12.2					5.8	N	24.0	16/22	1019.4
CHLV2	36.9N	075.7W	681	23.3	24.4				10.5	NE	27.0	05/06	1016.5
CLKN7	34.6N	076.5W	669	25.2					8.9	SW	29.0	04/11	1016.2
CSBF1	29.7N	085.4W	683	26.1					4.7	N	21.0	11/22	1014.7
DBLN6	42.5N	079.4W	679	17.8					8.1	SE	31.0	23/23	1015.0
DESW1	47.7N	124.5W	682	12.4					6.4	NW	30.0	14/16	1018.6
DISW3	47.1N	090.7W	681	15.3					9.8	SW	27.0	17/17	1013.8
DPIA1	30.3N	088.1W	678	26.3	28.0				9.1	N	25.4	30/13	1014.6
DSLN7	35.2N	075.3W	682	25.2	26.6				11.4	NE	32.0	05/11	1017.1
FBIS1	32.7N	079.9W	680	25.5					6.3	SW	22.0	04/12	1015.8
FFIA2	57.3N	133.6W	683	10.2					11.3	SE	30.0	17/11	1014.3
FPSN7	33.5N	077.6W	681	26.0					10.8	E	32.0	04/15	1015.5
GDIL1	29.3N	090.0W	682	26.8	28.3				7.1	NE	21.0	23/07	1014.8
GLLN6	43.9N	076.4W	662	17.0					11.2	W	28.0	26/14	1015.3
IOSN3	43.0N	070.6W	681	15.7					11.6	W	32.0	20/15	1016.8
LKWF1	26.6N	080.0W	681	27.7	29.8				6.1	SE	29.0	23/20	1015.2
MDRM1	44.0N	068.1W	682	12.8					13.8	SW	35.1	21/12	1015.8
MISM1	43.8N	068.9W	681	13.3					14.1	SW	36.1	14/05	1016.5
NWPO3	44.6N	124.1W	683	12.0					6.4	N	25.0	14/18	1018.7
PILM4	48.2N	088.4W	682	13.9					10.1	W	27.0	23/09	1013.6
PTAC1	39.0N	123.7W	683	12.4					7.9	N	22.0	04/20	1016.4
PTAT2	27.8N	097.1W	453	27.0					11.7	SE	21.0	16/02	1014.6
PTGC1	34.6N	120.7W	679	14.8					15.8	N	29.0	02/07	1014.9
ROAM4	47.9N	089.3W	682	14.2					12.4	N	29.0	23/10	1013.6
SAUF1	29.9N	081.3W	568	26.0					6.8	E	19.8	04/23	1015.7
SBIO1	41.6N	082.8W	677	18.8					8.9	S	33.1	30/18	1014.4
SGNW3	43.8N	087.7W	681	16.1	16.6				8.2	W	22.0	02/02	1014.5
SISW1	48.3N	122.8W	682	12.7					5.8	W	24.0	26/08	1017.0
SPGF1	26.7N	079.0W	661	28.3	30.2				3.1	SE	17.9	26/15	1014.9

U.S. NDBC Climatological Data cont'd

July, August and September 1987

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN WAVE HT (M)	MAX WAVE HT (M)	MAX WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
SRST2	29.7N	094.1W	683	25.6					6.4	S	17.0	16/07	1015.1
STDM4	47.2N	087.2W	680	15.2	16.0				13.3	N	31.0	30/13	1014.0
SVLS1	32.0N	080.7W	681	26.3	28.3				9.8	SE	24.4	12/20	1015.6
TPLM2	38.9N	076.4W	681	21.6	23.4				8.9	S	23.0	08/21	1016.0
TTIW1	48.4N	124.7W	683	12.4					8.9	S	30.0	30/09	1018.7
VENF1	27.1N	082.5W	678	26.7	30.2				5.8	E	35.1	30/14	1014.8
WPOW1	47.7N	122.4W	683	14.3					5.8	NE	21.0	14/22	1017.8

Selected Gale and Wave Observations

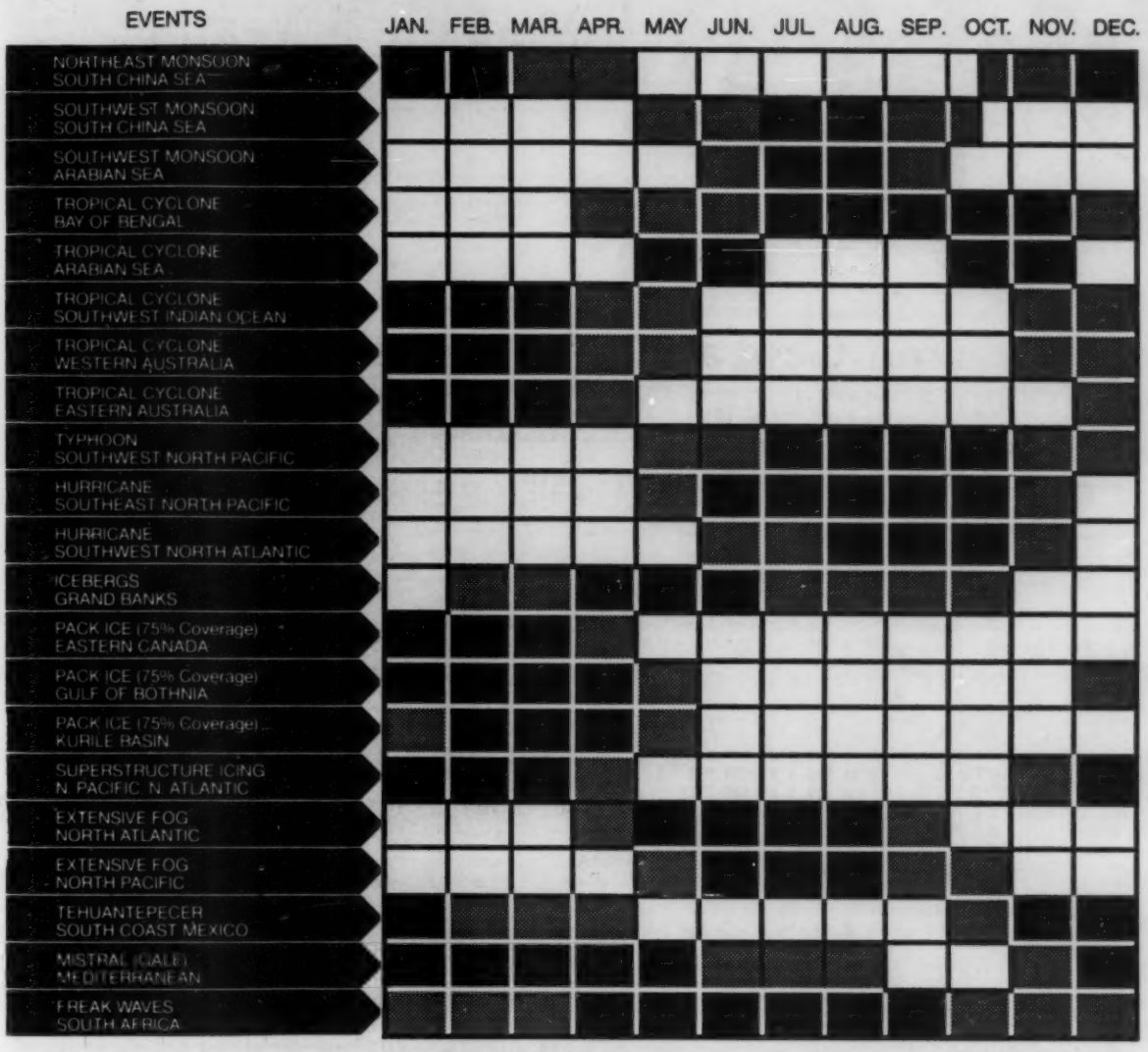
July, August and September, 1987

VESSEL	SHIP CALL	DATE	POSITION LAT. deg.	POSITION LONG. deg.	TIME GMT	WIND DIR. 10 deg.		WIND SPEED kts.	VSBY	PRES WX. code	PRESSURE mbs.	TEMP deg C. Air	TEMP deg C. Sea	SEA WAVES PD. sec	SEA WAVES HGT. ft.	SWELL WAVES DIR	SWELL WAVES PD. sec	SWELL WAVES HGT. ft.
	PACIFIC	JULY																
MOBIL MERIDIAN	KGSM	9	38.5 N	124.2 W	06	34		40	5 NM		1011.7	13.9	15.6	5	19.5			
SEALAND DEFENDER	KGJB	14	46.9 N	171.5 W	10	14	M	40	1 NM	63	1005.2	10.0		4	14.5	14	8	19.5
SEALAND DEFENDER	KGJB	14	46.9 N	170.2 W	13	15	M	40	1 NM	63	1005.7	10.0		4	14.5	14	8	19.5
SEALAND DEFENDER	KGJB	14	46.9 N	169.8 W	14	15	M	40	1 NM	63	1005.9	10.0		4	14.5	14	8	19.5
AQUA GARDEN	C6BD9	15	52.3 N	178.6 W	00	06	M	40	.5 NM	41	0997.5	8.0	6.0	10	16.5	06	12	19.5
PRESIDENT GRANT	WEZD	15	50.0 N	165.6 W	00	13		40	2 NM	63	1011.5	8.3	10.0	5	19.5	18	5	19.5
PRESIDENT ARTHUR	WGLA	15	28.5 N	130.3 E	06	18	M	40	5 NM	02	1002.5	28.9	26.7	5	13	19	10	21
PRESIDENT GRANT	WEZD	15	50.0 N	154.2 W	12	13		40	2 NM	63	1011.2	6.7	8.9	5	19.5	17	5	19.5
PRESIDENT GRANT	WEZD	16	50.0 N	152.8 W	00	16		43	1 NM	63	1018.2	9.4	8.9	25	23	11	5	14.5
ATIGUN PASS	KSFJ	29	16.0 N	99.3 W	06	11		50	200 YD	82	1009.2	24.4	29.4	8	19.5	13	8	16.5
	PACIFIC	AUG.																
PRESIDENT HARDING	WGXO	4	52.3 N	167.2 W	18	26		40	5 NM	02	0996.5	10.0		10	18	25	12	19.5
LNG TAURUS	WDZW	26	20.1 N	133.0 E	06	17	M	43	5 NM	02	1005.8	28.5	30.0	10	10	18	15	24.5
LNG TAURUS	WDZW	26	19.3 N	133.2 E	11	16	M	43	5 NM		1006.2	27.5	24.4	8	19.5	23	15	29.5

VESSEL	SHIP CALL	DATE	POSITION LAT. deg.	POSITION LONG. deg.	TIME GMT	WIND DIR. 10 deg.		WIND SPEED kts.	VSBY	PRES WX. code	PRESSURE mbs.	TEMP deg C. Air	TEMP deg C. Sea	SEA WAVES PD. sec	SEA WAVES HGT. ft.	SWELL WAVES DIR	SWELL WAVES PD. sec	SWELL WAVES HGT. ft.
	ATLANTIC	AUG.																
SEALAND CONSUMER	WCHF	25	48.3 N	23.2 W	00	32		40	2 NM		1018.0	16.5	15.6	5	6.5	32	7	19.5
	PACIFIC	SEP.																
NATIONAL DIGNITY	DZRG	2	49.9 N	172.1 W	12	21	M	40	200 YD		1003.0	10.0	12.0	15	19.5	22	18	24.5
EXXON VALDEZ	WHCB	13	51.9 N	135.9 W	18	30	M	41	1 NM	10	0983.0	12.8				30	12	24.5
LEISE MAERSK	OXDW	14	48.4 N	141.5 W	00	33		40	1 NM	50	0994.8	13.2		11	26			
SEA BELLS	ELCN7	15	48.9 N	135.0 W	00	27	M	40	2 NM	07	1008.0	14.0	13.0	7	14.5	28	8	19.5
SKAUBORD	ELHC8	16	38.4 N	144.2 E	18	05	M	40			1006.0	20.0	22.0	5	19.5	18	6	23
PRESIDENT GARFIELD	WGXN	17	29.8 N	144.5 E	06	25	M	46	5 NM	07	0997.1	28.9		8	14.5	29	14	26
PRESIDENT GARFIELD	WGXN	17	29.9 N	147.0 E	12	24	M	44	10 NM	00	0999.6	26.7		8	21	30	13	26
PRESIDENT HOOVER	WTST	17	35.2 N	141.0 E	18	36	M	40	5 NM		0999.6	19.4	22.8	5	13	01	8	26
DRAGOR MAERSK	OVYZ	18	37.7 N	144.7 E	00	35		40	1 NM	59	0995.7	19.5		3	10	36	10	19.5
PRINCE WILLIAM SOUND	WSDX	19	59.5 N	145.0 W	18	09		45	2 NM	62	0984.0	9.9	11.0	8	19.5			
PRESIDENT LINCOLN	KDBG	21	39.5 N	137.4 W	06	18		42	5 NM	01	1007.1	18.9	19.4	9	19.5	24	16	29.5
ACE ACCORD	DULV	21	52.7 N	174.6 W	12	21	M	49	2 NM	63	0972.5	10.0	17.0	10	19.5			
ACE ACCORD	DULV	22	52.3 N	176.7 W	00	29	M	50	1 NM	60	0987.5	10.0	16.0	10	44	29	10	44
ACE ACCORD	DULV	22	52.2 N	177.5 W	06	33	M	46	1 NM	60	1012.5	9.0	16.0	10	44	33	10	44
ACE ACCORD	DULV	22	52.3 N	178.4 W	12	32	M	50	1 NM	60	1012.5	8.0	16.0	10	44	31	10	44
LARS MAERSK	OXMD	23	42.3 N	166.7 W	00	30	M	55	10 NM		1020.5	12.0	14.0	8	26			

VESSEL	SHIP CALL	DATE	POSITION LAT. deg.	POSITION LONG. deg.	TIME GMT	WIND DIR. 10 deg.		WIND SPEED kts.	VSBY	PRES WX. code	PRESSURE mbs.	TEMP deg C. Air	TEMP deg C. Sea	SEA WAVES PD. sec	SEA WAVES HGT. ft.	SWELL WAVES DIR	SWELL WAVES PD. sec	SWELL WAVES HGT. ft.
	ATLANTIC	SEP.																
SEALAND LEADER	WSNH	25	43.2 N	37.3 W	06	27		47	5 NM	02	0998.0	19.0		5	6.5	26	10	23
SEALAND LEADER	WSNH	25	43.7 N	34.9 W	12	29		42			1001.5	19.0		5	6.5	29	12	23
TULSIDAS	ATUJ	25	41.2 N	35.4 W	18	32	M	52	5 NM		1014.5	22.5	20.1	XX	14.5	31	XX	29.5
SEALAND LEADER	WSNH	25	43.1 N	32.8 W	18	31		40			1006.0	20.0		5	6.5	31	12	19.5
CHELSEA	KNCX	29	52.0 N	18.7 W	18	16		43	2 NM	81	1005.3	15.6	15.0	11	24.5	17	14	19.5

Meteorological Events by Month



Period of Likely Occurrence

Peak Period

Courtesy of

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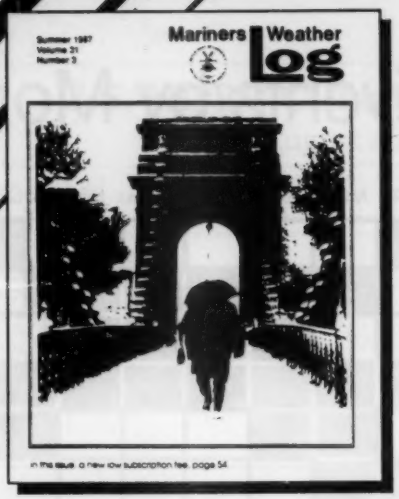

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Port Meteorological Officers — U.S. and Canada

Atlantic Ports

Mr. Peter Connors, PMO
National Weather Service, NOAA
1600 Port Boulevard
Miami, FL 33132
305-358-6027

Mr. Lawrence Cain, PMO
National Weather Service, NOAA
Jacksonville International Airport
Box 18367
Jacksonville, FL 32229
904-7571730 (FTS 946-3620)

Mr. Earle Ray Brown Jr., PMO
National Weather Service, NOAA
Norfolk International Airport
Norfolk, VA 23518
804-441-6326 (FTS 827-6326)

PMO
National Weather Service, NOAA
Building 51
Newark International Airport
Newark, NJ 07114
201-624-8098 (FTS 341-6188)

Mr. Robert Baskerville, PMO
National Weather Service, NOAA
30 Rockefeller Plaza
New York, NY 10112
212-399-5569 (FTS 662-5569)

Mr. Michael McNeil
Atmospheric Environment Service
1496 Bedford Highway
Bedford, (Halifax) Nova Scotia
B4A 1E5
902-835-5830

Mr. Denis Blanchard
Atmospheric Environment Service
100 Alexis Nihon Blvd., 3rd Floor
Ville St. Laurent, (Montreal) Quebec
H4M 2N6
514-283-6325

Mr. Guy Phillpott, PMO
Atmospheric Environment Service
Bldg. 303, Pleasantville
P.O. Box 9490, Postal Station "B"
St. John's, Newfoundland
A1A 2Y4
709-772-4798

Pacific Ports

Mr. Akimichi Kimura, W/PR12x2
Pacific Region, NWS, NOAA
Prince Kuhio Fed. Bldg., Rm 4110
P.O. Box 50027
Honolulu, HI 96850
808-541-1659

Mr. Robert Webster, PMO
National Weather Service, NOAA
2005 T Custom House
300 South Ferry Street
Terminal Island, CA 90731
213-514-6178 (FTS 795-6178)

Mr. James Mullick, PMO
National Weather Service, NOAA
Government Island Bldg. 3
Alameda, CA 94501
415-273-6257 (FTS 536-6257)

Mr. David Bakeman, PMO
National Weather Service, NOAA
7600 Sand Point Way, N.E.
BIN C15700
Seattle, WA 98115
206-526-6100 (FTS 392-6100)

Mr. Ron McLaren, PMO
Atmospheric Environment Service
700-1200 W. 73rd Av.
Vancouver, British Columbia
V6P 6H9
604-666-0360

Mr. Robert Bonner, OIC
National Weather Service, NOAA
Box 37, USCG Base
Kodiak, AK 99619
907-487-2102/ 4338

Mr. Lynn Chrystal, OIC
National Weather Service, NOAA
Box 427
Valdez, AK 99686
907-835-4505

Mr. Andrew Brewington W/AR121x3
Alaska Region, NWS, NOAA
701 C Street, Box 23
Anchorage, AK 99513
907-271-5121

Republic of Panama

Mr. Robert Melrose, PMO
National Weather Service, NOAA
Box 1301
APO Miami, FL 34005
Local: National Port Authority (APN)
Bldg. 1010, Cristobal
Tel. 467205

Great Lakes Ports

Mr. Bob Collins, PMO
National Weather Service, NOAA
10600 West Higgins Road
Rosemont, IL 60018
312-298-1263 (FTS 353-4680/2455)

Mr. George Smith, PMO
National Weather Service, NOAA
Hopkins International Airport
Federal Facilities Bldg.
Cleveland, OH 44135
216-267-0069 (FTS 942-4949/4517)

Mr. Geoffery Meek
Atmospheric Environment Service
25 St. Clair Av. East
Toronto, Ontario
M4T 1M2
416-973-5809

Mr. Ronald Fordyce
Atmospheric Environment Service
Federal Building
Thorold, Ontario
L2V 1W0
416-227-0238

Gulf of Mexico Ports

Mr. Jim Downing, PMO
National Weather Service, NOAA
Int'l Airport, Moisant Field, Box 20026
New Orleans, LA 70141
504-469-4648 (FTS 682-6694)

Mr. James Nelson
National Weather Service, NOAA
Route 6, Box 1048
Alvin, TX 77511
713-331-3752 (FTS 526-5834)

Headquarters

Mr. Vincent Zegowitz
Marine Obs. Program Leader
National Weather Service, NOAA
8060 13th St.
Silver Spring, MD 20910
301-427-7724 (FTS 427-7724)

Mr. Martin Baron
VOS Program Manager
National Weather Service, NOAA
8060 13th St.
Silver Spring, MD 20910
301-427-7724 (FTS 427-7724)

Mr. George Payment
Marine Meteorological Officer (AWDH)
Atmospheric Environment Service
4905 Dufferin St.
Downsview, Ontario
M3H 5T4
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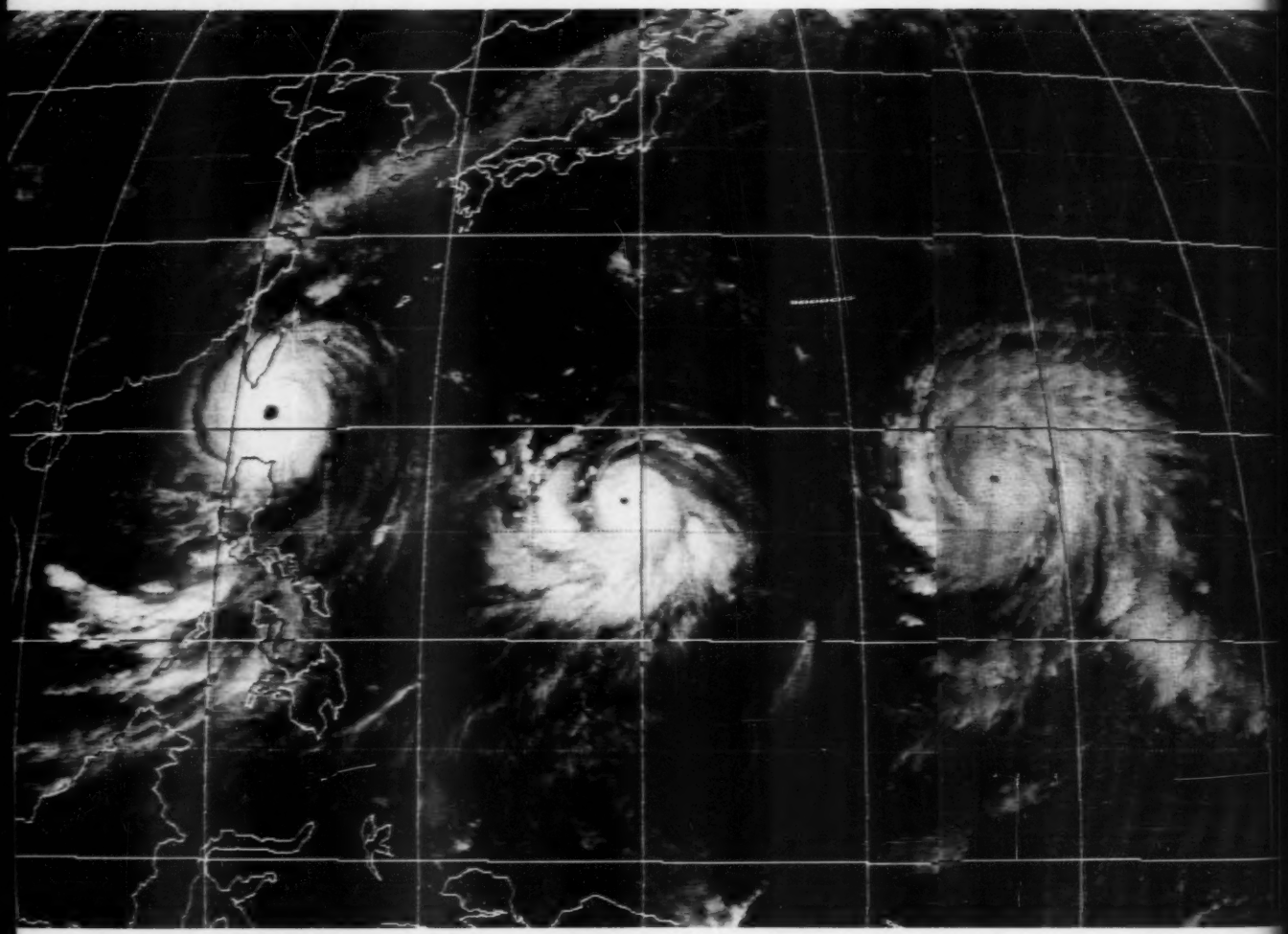

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